SOIL SURVEY

Clarion County Pennsylvania

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
PENNSYLVANIA STATE UNIVERSITY
College of Agriculture and Experiment Station

How to Use THE SOIL SURVEY REPORT

THIS SOIL SURVEY gives basic facts about the soils of Clarion County. These facts will increase our understanding of the land on which we live and our ability to work with nature. They will aid us in using the land most efficiently, in selecting the crops best adapted to the soils, in the use of fertilizer, and in applying methods for conserving soil and water. They will help engineers, foresters, and construction workers in their use of the soils.

In making this survey, soil scientists walked over the fields and woodlands. They bored holes and examined the soil brought up on the auger. They noted the color, the texture or "feel," and the thickness of the different layers. Many places they dug a hole with a shovel or scraped a roadbank with a mattock to learn more about the structure and arrangement of the soil. They measured the steepness of slopes with a hand level. For each soil, they recorded these characteristics and others that would affect the use of the soil or its placement in the standard system of soil classification. Then, on a large aerial photograph, they drew a boundary around each soil area and identified it by a symbol. All areas of the same kind of soil were marked with the same symbol. These boundaries and symbols were then copied from the aerial photograph, or field map, to form a soil map. The soil map consists of the 50 sheets bound in the back of this report.

A soil survey provides a foundation for all land use programs. The reader may be interested in the whole report or only some particular part. Some readers will be interested mainly in the soils on one farm, or just a few farms. Others will be concerned with a countywide view of the soils.

For information about the soils on one farm, first locate the farm by using the index to map sheets. This is a small map of the county on which numbered rectangles have been drawn to show where each sheet of the large map is located. When the map sheet has been located, find the boundaries of the farm. Note the different soil symbols. Look up the names for these symbols on the legend sheet that accompanies the map. Then turn to the section, Soils of Clarion County, and read about each soil on the farm. Further information about each soil will be found in the section, Use and Management of Soils. In this section the soils are placed in capability units, and the management for each unit is discussed. For relative productivity of the soils, refer to table 1.

The section, General Soil Areas, gives a broad summary of soil conditions in the whole county. If the interest is in forests, turn to the part of the section, Use and Management of Soils, that discusses forest management. If the main interest is engineering, read the part of this report concerned with soil characteristics as they relate to engineering uses of soils. Persons interested in soils as a part of the natural landscape will want to read the section, Soils and Their Environment, which deals with the processes of soil formation and the relation of the soils to the environment in which they were formed.

Contents

	Page
General soil areas	1
Somewhat wet soils on flats and well-drained soils on slopes, chiefly in the northwestern part of county:	
Cavode-Armagh-Gilpin (CAG)	1
Soils on ridgetops and slopes, chiefly in the northeastern part of the county:	
Clymer-Cookport-Dekalb (CCD)	2
Steep, stony soils:	
Dekalb (D)	2
Soils on ridges and steep slopes in the southern part of the county:	
Gilpin-Ernest (GE)	2
Soils on ridges, flats, and slopes in the southern part of the county:	
Gilpin-Rayne-Ernest (GRE)	2
Soils on benches along Redbank and other creeks:	
Holston-Monongahela (HM)	3
Soils on benches underlain by gravel, chiefly along the Allegheny River:	
Wheeling-Sciotoville (WS)	3
Soils on flood plains	3
Use and management of soils	3
Land-capability classification	3
Capability units in Clarion County	5
Unit I-1	5
Unit I-2	5
Unit IIe-1	6
Unit IIe-2	6
Unit IIe-3	6
Unit IIe-4	6
Unit IIe-5	6
Unit IIe-6	7
Unit IIw-1	7
Unit IIw-2	8
Unit IIIe-1	8
Unit IIIe-2	8
Unit IIIe-3	8
Unit IIIe-4	9
Unit IIIe-5	9
Unit IIIe-6	10
Unit IIIw-1	10
Unit IIIw-2	10
Unit IVe-1	11
Unit IVe-2	11
Unit IVe-3	11
Unit VIe-1	12
Unit VIe-2	12
Unit VIe-3	12
Unit VIs-1	12
Unit VIw-1	12
Unit VIw-2	12
Unit VIIe-1	12
Unit VIIe-2	13
Unit VIIIs-1	13
Management of cropland, pasture, and woodland	13
Soil productivity	14
Engineering properties of the soils	16
Soils of Clarion County	19
Armagh series	21
Armagh silt loam, 0 to 2 percent slopes	21
Armagh silt loam, 2 to 8 percent slopes	21
Armagh silt loam, 2 to 8 percent slopes, severely eroded	22
Armagh silt loam, 8 to 15 percent slopes	22
Armagh stony silt loam, 0 to 8 percent slopes	22
Atkins series	22
Atkins silt loam, 0 to 5 percent slopes	22
Brinkerton series	23
Brinkerton silt loam, 0 to 2 percent slopes	23
Brinkerton silt loam, 2 to 10 percent slopes	23
Brinkerton stony silt loam, 0 to 8 percent slopes	23
Cavode series	23
Cavode channery silt loam, 2 to 8 percent slopes	24
Cavode channery silt loam, 8 to 15 percent slopes	24
Cavode silt loam, 0 to 2 percent slopes	24
Cavode silt loam, 2 to 8 percent slopes	24
Cavode silt loam, 2 to 8 percent slopes, severely eroded	25
Cavode silt loam, 8 to 15 percent slopes	25
Cavode silt loam, 8 to 15 percent slopes, severely eroded	25
Cavode silt loam, 15 to 25 percent slopes	25
Cavode silt loam, 15 to 25 percent slopes, severely eroded	26
Cavode silt loam, 25 to 35 percent slopes, eroded	26
Cavode silt loam, concretionary variant, 0 to 2 percent slopes	26
Cavode silt loam, concretionary variant, 2 to 8 percent slopes	26
Cavode silt loam, concretionary variant, 8 to 15 percent slopes	26
Cavode stony silt loam, 2 to 15 percent slopes	26
Cavode stony silt loam, 15 to 30 percent slopes	27
Clymer series	27
Clymer channery loam, 0 to 5 percent slopes	27
Clymer channery loam, 5 to 12 percent slopes	27
Clymer channery loam, 12 to 25 percent slopes	27
Clymer loam, 0 to 5 percent slopes	27
Clymer loam, 5 to 12 percent slopes	28
Cookport series	28
Cookport channery loam, 2 to 8 percent slopes	28
Cookport channery loam, 8 to 15 percent slopes	28
Cookport channery silt loam, 0 to 2 percent slopes	29
Cookport channery silt loam, 2 to 8 percent slopes	29
Cookport channery silt loam, 8 to 15 percent slopes	29
Cookport channery silt loam, 15 to 30 percent slopes	29
Cookport silt loam, 0 to 2 percent slopes	30
Cookport silt loam, 2 to 8 percent slopes	30
Cookport silt loam, 8 to 15 percent slopes	30
Cookport stony silt loam, 0 to 15 percent slopes	30
Cookport stony silt loam, 15 to 30 percent slopes	30
Dekalb series	30
Dekalb channery loam, 0 to 5 percent slopes	30
Dekalb channery loam, 5 to 12 percent slopes	31
Dekalb channery loam, 12 to 25 percent slopes	31
Dekalb channery loam, 12 to 25 percent slopes, severely eroded	31
Dekalb channery loam, 25 to 35 percent slopes	31
Dekalb channery loam, 25 to 35 percent slopes, severely eroded	31
Dekalb channery loam, 35 to 60 percent slopes	31
Dekalb channery sandy loam, 0 to 5 percent slopes	31
Dekalb channery sandy loam, 5 to 12 percent slopes	32
Dekalb channery sandy loam, 12 to 25 percent slopes	32
Dekalb channery sandy loam, 12 to 25 percent slopes, severely eroded	32
Dekalb channery sandy loam, 25 to 35 percent slopes	32
Dekalb channery sandy loam, 35 to 60 percent slopes	32
Dekalb loam, 0 to 5 percent slopes	33
Dekalb loam, 5 to 12 percent slopes	33
Dekalb loam, 12 to 25 percent slopes	33
Dekalb stony loam, 0 to 25 percent slopes	33
Dekalb stony loam, 25 to 35 percent slopes	33
Dekalb stony loam, 35 to 75 percent slopes	33
Ernest series	33
Ernest silt loam, 0 to 8 percent slopes	34
Ernest silt loam, 0 to 8 percent slopes, severely eroded	34
Ernest silt loam, 8 to 15 percent slopes	35
Ernest silt loam, 8 to 15 percent slopes, severely eroded	35
Ernest silt loam, 15 to 30 percent slopes	35
Ernest stony silt loam, 2 to 15 percent slopes	35
Ernest stony silt loam, 15 to 30 percent slopes	35

Page

Soils of Clarion County—Continued
Gilpin series 35
Gilpin channery loam, 0 to 5 percent slopes..... 36
Gilpin channery loam, 5 to 12 percent slopes 36
Gilpin channery loam, 12 to 25 percent slopes 36
Gilpin channery loam, 12 to 25 percent slopes, severely eroded 37
Gilpin channery silt loam, 0 to 5 percent slopes.. 37
Gilpin channery silt loam, 5 to 12 percent slopes 37
Gilpin channery silt loam, 12 to 25 percent slopes 37
Gilpin channery silt loam, 12 to 25 percent slopes, severely eroded 37
Gilpin shaly silt loam, 0 to 5 percent slopes..... 38
Gilpin shaly silt loam, 5 to 12 percent slopes..... 38
Gilpin shaly silt loam, 5 to 12 percent slopes, severely eroded 38
Gilpin shaly silt loam, 12 to 25 percent slopes 38
Gilpin shaly silt loam, 12 to 25 percent slopes, severely eroded 38
Gilpin silt loam, 0 to 5 percent slopes 39
Gilpin silt loam, 5 to 12 percent slopes 39
Gilpin silt loam, 12 to 25 percent slopes 39
Gilpin stony silt loam, 0 to 25 percent slopes 39
Gilpin stony silt loam, 25 to 60 percent slopes 40
Gilpin soils, 25 to 35 percent slopes 40
Gilpin soils, 25 to 35 percent slopes, severely eroded 40
Gilpin soils, 35 to 60 percent slopes 40
Gilpin soils, 35 to 60 percent slopes, severely eroded 40
Ginat series 41
Ginat silt loam, 0 to 5 percent slopes 41
Gravel pits 41
Gravelly terraces 41
Gravelly terraces, 12 to 25 percent slopes 41
Gravelly terraces, 25 to 45 percent slopes 42
Holston series 42
Holston silt loam, 0 to 2 percent slopes 42
Holston silt loam, 2 to 8 percent slopes 42
Holston silt loam, 8 to 15 percent slopes 42
Leetonia series 42
Leetonia stony sandy loam, 0 to 25 percent slopes 42
Leetonia stony sandy loam, 25 to 60 percent slopes 43
Lickdale series 43
Lickdale silt loam, 0 to 2 percent slopes 43
Lickdale silt loam, 2 to 10 percent slopes 43
Lickdale stony silt loam, 0 to 8 percent slopes 43
Made land 44
Mine dumps 44
Monongahela series 44
Monongahela silt loam, 0 to 2 percent slopes 44
Monongahela silt loam, 2 to 8 percent slopes 44
Monongahela silt loam, 8 to 15 percent slopes 45
Monongahela silt loam, 15 to 25 percent slopes 45
Nolo series 45
Nolo silt loam, 0 to 2 percent slopes 45
Nolo silt loam, 2 to 10 percent slopes 45
Nolo stony silt loam, 0 to 8 percent slopes 45
Philo series 45
Philo fine sandy loam, 0 to 6 percent slopes 46
Philo silt loam, 0 to 6 percent slopes 46
Pope series 46
Pope fine sandy loam, 0 to 5 percent slopes 47

Page

Pope fine sandy loam, 5 to 8 percent slopes 47
Pope silt loam, 0 to 5 percent slopes 47
Rayne series 47
Rayne silt loam, 0 to 5 percent slopes 47
Rayne silt loam, 5 to 12 percent slopes 47
Rayne silt loam, 12 to 25 percent slopes 48
Sciotoville series 48
Sciotoville silt loam, 0 to 2 percent slopes 48
Sciotoville silt loam, 2 to 8 percent slopes 48
Sciotoville silt loam, 8 to 15 percent slopes 48
Shelocta series 48
Shelocta silt loam, 2 to 8 percent slopes 49
Shelocta silt loam, 8 to 15 percent slopes 49
Strip mine spoil 49
Tyler series 50
Tyler silt loam, 0 to 2 percent slopes 50
Tyler silt loam, 2 to 10 percent slopes 50
Westmoreland series 50
Westmoreland silt loam, 0 to 5 percent slopes 50
Westmoreland silt loam, 5 to 12 percent slopes.... 50
Westmoreland silt loam, 12 to 25 percent slopes.. 51
Westmoreland silt loam, 25 to 35 percent slopes, eroded 51
Wharton series 51
Wharton silt loam, 0 to 2 percent slopes 51
Wharton silt loam, 2 to 8 percent slopes 51
Wharton silt loam, 8 to 15 percent slopes 52
Wharton silt loam, 15 to 25 percent slopes 52
Wharton silt loam, concretionary variant, 0 to 5 percent slopes 52
Wharton silt loam, concretionary variant, 5 to 12 percent slopes 52
Wharton silt loam, concretionary variant, 12 to 30 percent slopes, eroded 52
Wheeling series 52
Wheeling gravelly loam, 0 to 8 percent slopes 53
Wheeling gravelly loam, 8 to 15 percent slopes.... 53
Wheeling silt loam, 0 to 2 percent slopes 53
Wheeling silt loam, 2 to 8 percent slopes 53
Wheeling silt loam, 8 to 15 percent slopes 53
Wheeling silt loam, 15 to 25 percent slopes 53
Soils and their environment 54
Climate 54
Bedrock as soil material 54
Land forms 55
Vegetation and soils 56
Classification of soils 57
Gray-Brown Podzolic—Red-Yellow Podzolic intergrade 58
Gray-Brown Podzolic—Lithosol intergrade 59
Red-Yellow Podzolic—Planosol intergrade 59
Podzol 59
Sol Brun Acide 60
Low-Humic Gley 60
Humic Gley 60
Alluvial 60
Early settlement and development 60
Agriculture 61
Land use 61
Principal crops 61
Crop rotations 62
Agricultural improvement programs 62
Bibliography 62

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SOIL SURVEY OF CLARION COUNTY, PENNSYLVANIA

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UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH THE PENNSYLVANIA STATE UNIVERSITY, COLLEGE OF AGRICULTURE AND EXPERIMENT STATION

CLARION COUNTY, in the west-central part of Pennsylvania (fig. 1), has a total area of 599

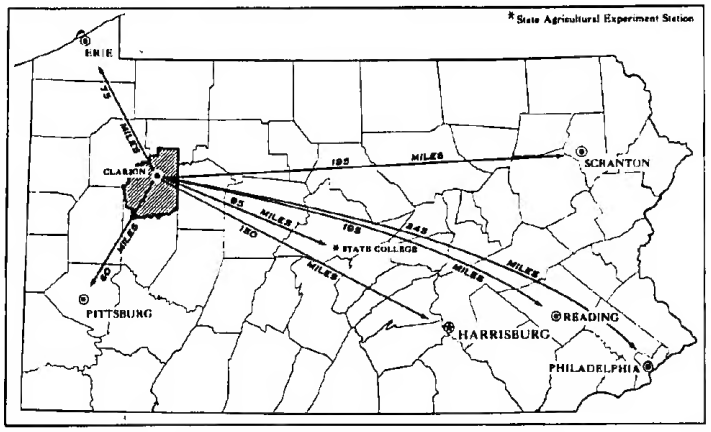

FIGURE 1.—Location of Clarion County in Pennsylvania.

square miles, or 383,360 acres. Redbank Creek forms the southern boundary, and the Allegheny River forms a large part of the western. Clarion, the county seat, is on the Clarion River and is near the geographical center of the county.

The county is mainly an agricultural region. Dairying farm production into cash. The chief crops—hay, and livestock products are the principal means of turning farm production into cash. The chief crops—hay, oats, corn, and wheat—are used mainly to feed livestock on the farms.

General Soil Areas

Study of the soil maps reveals that seven fairly distinct patterns of different soils occur in the county. Each kind of soil pattern forms one of the general soil areas shown on the colored map at the back of this report. In the northwestern part, near Knox, for example, the pattern consists of the somewhat wet Cavode and Armagh soils on broad ridges and gentle slopes and the more shallow sloping or steep Gilpin soils on hillsides.

Somewhat Wet Soils on Flats and Well-Drained Soils on Slopes, Chiefly in the Northwestern Part of County: Cavode-Armagh-Gilpin (CAG)

In this general area soils of the Cavode, Armagh, and Gilpin series are dominant (fig. 2). The Cavode soils have somewhat poor natural drainage, and the

FIGURE 2.—Cavode, Armagh, Ernest, and Brinkerton soils on typical rounded topography in northwestern part of county.

Armagh have poor natural drainage. Both are underlain by clay shales, and both occupy upland flats and gentle slopes. The Gilpin soils, which occur on slopes, are shallow or moderately deep over sandstone or shale. The other soils in this general soil area are members of the Lickdale and the Wharton series. The Lickdale soils have a dark-colored surface soil and are very poorly drained. The Wharton soils are moderately well drained but have a tight subsoil that overlies blocky clay shale. Locally, where the bedrock contains some limestone or limy material, there are areas of Westmoreland soils or of concretionary variants of Cavode and Wharton soils. The Westmoreland soils resemble the Gilpin soils but are not so acid.

On most farms in this area, a large part of the cropland is on moderately sloping soils. These soils are well suited to cultivation but require artificial drainage because of excess surface water. Dairy farming dominates over the other types of farming. Most of the feed is grown locally. There is considerable part-time farming.

Good-sized areas have been strip mined, and this mining is still in progress. Coal lies 5 to 50 feet deep under many broad areas on the gently sloping uplands. In some localities blocks of several farms have been abandoned to strip mining.

Soils on Ridgetops and Slopes, Chiefly in the Northeastern Part of the County: Clymer-Cookport-Dekalb (CCD)

This soil area consists mainly of soils of the Clymer, Cookport, and Dekalb series. Most of the area is on ridges and slopes in the northeastern part of the county. The soils are underlain chiefly by sandstone, and many of them are sandy. Some of the broad ridges and gently sloping uplands are several miles wide. They form a plain that, for the most part, has gentle slopes and a few low hills rising above it. Into this plain, especially near the Clarion River, the main streams have cut deep, narrow, steep-walled valleys.

In this area, the sloping and steep members of the Dekalb series are extensive on the hillsides. The Dekalb soils are shallow to moderately deep; most of them are sloping and sandy, and many are stony. The main soils on the uplands are the deep, well-drained Clymer soils and the deep and somewhat wet Cookport soils. Also on the uplands are smaller areas of Nolo soils, which have poor natural drainage and are shallow over a hard, brittle subsoil layer. Some areas are Leetonia soils, which are highly leached, stony, and very sandy.

The Cavode, Armagh, Wharton, Lickdale, and Gilpin soils, which were mentioned as occurring in the Cavode-Armagh-Gilpin soil area, occupy minor areas of upland in this general soil area. On lower slopes, mostly in narrow valleys, are some tracts of Ernest soils, which have medium or somewhat poor natural drainage, as well as some Brinkerton soils, which are poorly drained and in seepy spots.

Most of this general soil area has remained as woodland. The second- and third-growth trees provide little sawtimber but are producing mine timbers and pulpwood. Included in this soil area is the Cook Forest State Park, which has a stand of large, old hemlock trees.

Some of the gently sloping upland, mainly that on the less sandy soils, has been cleared for farming. Much of the land cleared after the trees were first cut is no longer farmed and is growing up to brush or is only slightly used for pasture. There are a few full-time dairy and poultry farms in the area, but most of the farming is a part-time operation.

Steep, Stony Soils: Dekalb (D)

This general soil area is dominated by Dekalb soils and lies chiefly along the Clarion River. The soils are mostly stony or channery loams or sandy loams. Nearly all of the area is forested.

Soils on Ridges and Steep Slopes in the Southern Part of the County: Gilpin-Ernest (GE)

This area consists mainly of Gilpin and Ernest soils on steep valley slopes. The Gilpin soils, as mentioned previously for the Cavode-Armagh-Gilpin area, are moderately deep over shale or sandstone and range from sloping to steep. The Ernest soils lie on lower slopes, where they were formed from an accumulation of material that washed downhill or was moved down by gravity. The Ernest soils have a mottled layer in their lower subsoil, which is evidence of somewhat poor natural drainage.

The Shelocta and Brinkerton soils occupy slopes on the lower parts of hillsides where soil material has accumulated. The Shelocta soils are better drained than the Ernest. Their subsoil is nearly free of mottling. The Brinkerton soils have poor natural drainage, which is indicated by the mottling in the subsurface and subsoil layers.

The Gilpin-Ernest area is occupied mostly by dairy farms and general farms. Some farms have been abandoned; others are operated on a part-time basis, and only the best fields are used. Most of the farms have some improved pasture. More of the total area pastured, however, is on the thin soils and moderately steep or steep slopes where productivity is low. Many of the pastures are weedy, and many are partly covered with brush. Erosion has been moderate or moderately severe on much of the cleared land.

Most of the farms have some woodland. The large trees have been removed from most of the woodland, and some of it has been clear-cut for everything large enough to make mine props.

Soils on Ridges, Flats, and Slopes in the Southern Part of the County: Gilpin-Rayne-Ernest (GRE)

Soils of the Gilpin, Rayne, and Ernest series are dominant in this area (fig. 3). The area covers most

FIGURE 3.—Landscape in southern part of county showing typical Gilpin-Rayne-Ernest soil association: Rayne silt loams on smooth ridges, Gilpin soils on slopes, and Ernest and Brinkerton soils on lower slopes.

of the upland in the southern third of the county. It contains soils of the same series as the Gilpin-Ernest area, but some of the ridges are wide enough that good-sized areas of Rayne soils occur on them. Slopes range from gentle to steep, but the general landscape is one of much less rugged relief than that of the Gilpin-Ernest area. The Rayne soils are deep and have good natural drainage that makes their subsoil almost free of mottling. The Rayne soils resemble the Clymer but are not quite so leached and acid. This general area contains small bodies of Cavode and Armagh soils and of several other soils.

Farms in this general area are much like those in the Gilpin-Ernest area, but the proportion on gentle or moderate slopes is generally somewhat greater. Considerable strip mining and some deep mining have been done. Strip-mine spoils and mine waste are typical parts of the landscape in both areas, but usually they are of smaller extent than in the Cavode-Armagh-Gilpin area.

Soils on Benches Along Redbank and Other Creeks: Holston-Monongahela (HM)

The main soils of this area are the Holston and Monongahela. They lie on the benches along Redbank Creek and some of the smaller streams. They have been formed in silty materials that are almost free from gravel. The Holston soils have good natural drainage, as is indicated by a subsoil nearly free from mottling. The Monongahela soils are moderately well drained; they are mottled in the lower subsoil. The Tyler soils have a tight clay subsoil and normally are mottled from the surface down. Most of the Tyler soils are gently sloping or nearly level.

As a rule, soils of this general area have been partly cleared and are used for farming. Several towns, among them Hawthorn and part of New Bethlehem, are located on these silty benches.

Soils on Benches Underlain by Gravel, Chiefly Along the Allegheny River: Wheeling-Sciotoville (WS)

The soils of this area are mostly members of the well-drained Wheeling, the moderately well drained Sciotoville, and the poorly drained and mottled Ginat series. They lie on gravelly benches along the Clarion and Allegheny Rivers. Their slopes are favorable for farming, and most of the acreage not occupied by towns is used as farmland. The towns of Foxburg and Callensburg are within this general soil area.

Soils on Flood Plains

The soils on flood plains are not delineated on the map as general soil areas, because they form parts of other soil areas already described. The soils of the flood plains are forming on nearly level tracts of stream-laid sediments. These narrow bands of soils are along all the streams, including the Alleghany River and the small runlets fed by springs. Nowhere are the bands wide enough to be shown separately on the map of general soil areas.

The soils belong to the Pope, Philo, and Atkins series. All have been deposited from flowing water and are subject to overflow at times of high water. The Pope soils have good natural internal drainage and are nearly free from mottling. The Philo soils are mottled in the lower subsoil, which indicates that they are moderately well drained. The Atkins soils are gray and poorly drained. They are wet most of the time unless they have been artificially drained.

Nearly every farm has a few acres of one or more of these soils. Frequency of flooding and degree of natural drainage greatly influence their use for crops and pasture. If flooding is not too frequent, the Pope and Philo soils are excellent as cropland.

Use and Management of Soils

This section consists of three parts. In the first, the kinds of soils mapped in the county are placed in capability units. Most of these capability units are groups of similar soils; some contain just one soil. The soils in each unit are listed, the features that they have in common are described, and suitable crops or other uses and the main needs for good management are given. The next part is short. It gives some suggestions for management of any soil used for crops, pasture, or woodland. The third part gives estimates of probable yields of the suitable crops on most of the soils and estimates of the productivity of well-managed pastures and woodlands on the soils of the county.

Land-Capability Classification

Land-capability classification is a grouping of soils to show their suitability for crops, grazing, forestry, or wildlife. This grouping is based on the uses that can be made of each soil, their needs for management, and the risks of erosion or other damages when so used. Since it is a practical grouping based on needs and responses, it can bring together in one group soils that were formed from different parent materials or in different ways. Soils that have similar needs for management, risks of damage, and general capabilities make up a capability unit, which can also be called a management group of soils. In Clarion County the soils have been placed in 30 capability units.

Capability units are grouped into eight general land-capability classes that are based on a rough summing up of the suitability of the soils for use, the risks of erosion or other damages in using them, and the resulting degrees of management need. The subclasses within the eight general classes help sort out the main kinds of factors that require different kinds of management.

The eight general land-capability classes range from class I, which consists of soils that are nearly level, productive, and not subject to erosion, to class VIII. Class VIII consists of soils and land types so rough, stony, wet, or otherwise so limited that they produce little or no useful vegetation.

Classes I, II, and III are suitable for the crops ordinarily grown in the locality that require annual or, at least, periodic tillage. Management needs or risks of damage, or both, are successively greater on soils in classes II and III than on those in class I. Soils in class IV are less suitable for a regular cropping system than those in the first three classes, but they can be used for tillage part of the time or with special precautions. In addition, soils in all four of these classes generally are well suited for uses that require little or no cultivation, such as grazing, forestry, or wildlife. Management needs and probable yields can vary greatly on the different soils in each class.

Soils not suitable for cultivation or that require extreme management of any kind, including those subject to severe erosion if cultivated, are placed in classes V, VI, VII, or VIII. Class V (none in this county) contains the soils that are nearly level and not subject to erosion, but are too wet, too frequently overflowed, or too stony for cultivation. Soils placed in class VI are more limited in one or more features than those soils in class IV. They will, however, supply forage, orchard crops, or forest products. Some can be cultivated enough to prepare them for long-time forage, orchards, planted forests, or special perennial crops.

Soils in class VII are more limited than those in class VI. Generally they must be managed by harvesting the native cover or a partly controlled succession of plants. The choices in management are fewer, production is less, or risk of erosion is greater than on the soils in class VI.

Class VIII consists of soils so severely limited that they produce little useful vegetation. They may provide attractive scenery or furnish shelter for wildlife. Some make up parts of watersheds on which runoff should be controlled.

Subclasses.—Each of the eight general classes contains soils that have limitations and management problems of about the same degree. The soils within a class may be of different kinds, and, therefore, the kinds of limitations are different. The dominant kind of limitation is indicated by one of four subclasses. The four subclasses are indicated thus: Risk of erosion if cover is not maintained, by the symbol (e); excess water either on or in the soil (w); shallow, droughty, or unusually infertile soil (s); or unusually hazardous climate (c). Subclasses (e), (w), and (s) occur in one or more of the broad classes in Clarion County.

Land capability units within each class and subclass are numbered consecutively, such as IIe-1, IIe-2, and so on. Within class I, there is usually no need to distinguish subclasses according to kinds of limiting factors, and the units are distinguished, therefore, by only the class number and a numeral, such as I-1.

The capability classes, subclasses, and units in Clarion County are given in the following list.

Capability Classes, Subclasses, and Units

Class I.—Deep or moderately deep, well-drained, nearly level productive soils. Suitable for intensive cultivation under good farming practices that will maintain organic matter and fertility.
- I-1: Deep or moderately deep, well-drained soils.
- I-2: Deep, well-drained silt loams or fine sandy loams on flood plains.

Class II.—Soils that can be cultivated with only moderate risk of erosion or that have other moderate limitations.
- IIe: Gently sloping to moderately sloping soils subject to moderate risk of erosion and requiring protection when cultivated.
  - IIe-1: Gently or moderately sloping, deep or moderately deep, well-drained soils.
  - IIe-2: Deep, well-drained, moderately sloping soil on flood plains.
  - IIe-3: Gently or moderately sloping, moderately deep, well-drained soils formed from material containing some limestone.
  - IIe-4: Nearly level or moderately sloping, shallow, well-drained shaly soils.
  - IIe-5: Nearly level or moderately sloping, moderately deep, well-drained loam or sandy loam soils on sandstone.
  - IIe-6: Gently sloping, deep, moderately well drained soils.
- IIw: Soils with slightly impeded natural drainage that makes them seasonally wet and that restricts their suitability for some sensitive crops.
  - IIw-1: Nearly level, deep, moderately well drained soils.
  - IIw-2: Nearly level, deep, moderately well drained, silt loam or fine sandy loam on flood plains.

Class III.—Soils that can be cultivated in a regular cropping system with moderately severe risk of erosion or that have other moderately severe limitations.
- IIIe: Gently sloping to moderately steep soils subject to moderately severe risk of erosion and needing protection when cultivated.
  - IIIe-1: Moderately sloping or moderately steep, shallow or moderately deep soils.
  - IIIe-2: Moderately steep soil formed from material containing some limestone.
  - IIIe-3: Moderately steep, shallow or moderately deep loams and sandy loams on sandstone.
  - IIIe-4: Moderately sloping, deep, moderately well drained soils.
  - IIIe-5: Gently or moderately sloping, somewhat poorly drained soils with tight clay subsoils.
  - IIIe-6: Gently sloping, poorly drained soils.
- IIIw: Nearly level soils that have poor or somewhat poor natural drainage and that need artificial drainage for production of most crops.
  - IIIw-1: Nearly level, poorly drained soils with tight, slowly permeable subsoils.
  - IIIw-2: Nearly level, somewhat poorly drained soil with tight clay subsoil.

Class IV.—Soils severely limited or subject to high risk of damage when used for tilled crops. They can be cultivated with special management.
- IVe: Moderately steep soils subject to severe erosion and needing extreme protection when cul-

tivated, and moderately sloping soils already severely eroded.

IVe-1: Moderately steep or steep, shallow to deep, well-drained soils.

IVe-2: Moderately steep or steep, shallow to moderately deep loams and sandy loams on sandstone.

IVe-3: Moderately steep or gently sloping and severely eroded, moderately well drained or somewhat poorly drained soils.

Class VI.—Soils ordinarily not suitable for cultivation because of steep slopes, poor drainage, stoniness, or other characteristics. Suitable for grazing or woodland with moderate restrictions or with care to meet the limitations.

VIe: Moderately sloping to steep, severely eroded, stony, or wet soils.

VIe-1: Moderately steep and steep, severely eroded shallow soils.

VIe-2: Moderately steep, somewhat poorly drained stony soil.

VIe-3: Moderately sloping, poorly drained soil with tight clay subsoil.

VIs: Soils too stony for cultivation.

VIs-1: Gently or moderately sloping, moderately well drained to somewhat poorly drained stony soils.

VIw: Nearly level, poorly drained soils that are too difficult to drain or too stony for cultivation.

VIw-1: Poorly or very poorly drained, mostly stony soils.

VIw-2: Poorly drained soil on flood plains that are subject to overflow.

Class VII.—Soils too steep, too stony, or otherwise not suitable for cultivation and severely limited for grazing or woodland use.

VIIe: Steep, stony, or severely eroded soils, and strip-mine areas.

VIIe-1: Very steep soils, steep stony or severely eroded soils, and moderately sloping, stony shallow soils.

VIIe-2: Very steep, stony soils, steep severely eroded soils, and disturbed soils.

Class VIII.—Land types that will not support crops or productive pasture or forest.

VIIIs-1: Gravel pits and mine dumps.

Capability units in Clarion County

This subsection provides a brief description of each of the capability units, a list of the soils in the unit, and suggestions for suitable crops, cropping systems, and principal management and conservation practices.

Soils in most of the capability units have many features in common. Distinctive features that affect use or management of certain individual soils are also given with descriptions of some of the units.

Specific statements about formulas for, and amounts of, fertilizer, varieties of crops, and seeding mixtures for pastures are not given in this section. Recommendations for these items change rapidly as new discoveries are made and as prices change. Up-to-date recommendations are published from time to time by the Pennsylvania Agricultural Experiment Station and Extension Service. The descriptions of the capability units and of the individual soils given in this report will help you select good uses and practices for each kind of soil. People of the local extension and soil conservation staffs will help you interpret the Statewide recommendations for the soils on your farm.

CAPABILITY UNIT I-1

Capability unit I–1 consists of deep or moderately deep, well-drained, medium-textured soils. These soils have good structure. They are permeable to water and air and have a moderate to moderately high water-supplying capacity. They are naturally acid and have only a moderate supply of plant nutrients.

The soils in capability unit I–1 are:

Clymer channery loam, 0 to 5 percent slopes.
Clymer loam, 0 to 5 percent slopes.
Gilpin channery loam, 0 to 5 percent slopes.
Gilpin channery silt loam, 0 to 5 percent slopes.
Holston silt loam, 0 to 2 percent slopes.
Wheeling silt loam, 0 to 2 percent slopes.

Use suitability and management needs.—The soils of capability unit I–1 are suitable for all the general farm crops grown in the area. Because they are naturally acid and only moderately supplied with plant nutrients, they need lime and fertilizer in amounts indicated by field-by-field tests and by the requirements of the crops to be grown. Although these soils can be intensively tilled with a minimum of special improvements and without great risk of erosion, organic matter and soil structure need to be maintained by a rotation that includes a grass or grass-and-legume mixture at least 1 year in 4. If this rotation does not fit cropping plans for a particular area, winter cover crops should be grown. Cover crops should be heavily fertilized and allowed to make as much growth as possible before they are plowed under.

CAPABILITY UNIT I-2

Capability unit I–2 consists of two soils of the flood plains. They are deep well-drained soils that have a medium or moderately coarse texture. They have weak structure but are permeable to water and have a moderate to moderately high water-supplying capacity. Floods usually last only a short time and come when crops can withstand wetness. The soils are naturally acid, but in farming areas they sometimes receive lime and other nutrients in floodwaters and in the deposits of silt.

The soils in capability unit I–2 are:

Pope fine sandy loam, 0 to 5 percent slopes.
Pope silt loam, 0 to 5 percent slopes.

Use suitability and management needs.—The soils of capability unit I–2 are well suited to general farm crops and to pasture. When cropped they need lime and fertilizer in amounts shown by soil tests. Along some streams, removal of snags and other obstructions in the channel may be needed to reduce flooding. Winter cover crops are needed where the soil is intensively used for tilled crops.

Pastures are frequently overgrazed because they are close to water and often have better grass than up-

land soils in the same fields. Rotated grazing, careful maintenance of fertility, and mowing of weeds will increase the yield of forage.

CAPABILITY UNIT IIe–1

Capability unit IIe–1 consists of gently to moderately sloping, deep or moderately deep, well-drained, medium-textured soils. These soils have good structure and are at least moderately permeable to water. They have a moderate moisture-supplying capacity. They are naturally acid and have only a moderate supply of plant nutrients. The two variants of Wharton silt loam included in this unit are exceptions to some of these general statements because they do not quite classify as well drained and because they are less permeable and less acid than other soils in the unit.

The soils in capability unit IIe–1 are:

Clymer channery loam, 5 to 12 percent slopes.
Clymer loam, 5 to 12 percent slopes.
Gilpin channery loam, 5 to 12 percent slopes.
Gilpin channery silt loam, 5 to 12 percent slopes.
Gilpin silt loam, 0 to 5 percent slopes.
Gilpin silt loam, 5 to 12 percent slopes.
Holston silt loam, 2 to 8 percent slopes.
Rayne silt loam, 0 to 5 percent slopes.
Rayne silt loam, 5 to 12 percent slopes.
Shelocta silt loam, 2 to 8 percent slopes.
Wharton silt loam, concretionary variant, 0 to 5 percent slopes.
Wharton silt loam, concretionary variant, 5 to 12 percent slopes.
Wheeling gravelly loam, 0 to 8 percent slopes.
Wheeling silt loam, 2 to 8 percent slopes.

Use suitability and management needs.—The soils of unit IIe–1 are well suited to pasture and to all the farm crops normally grown in the area. For good yields, however, it is necessary to lime and fertilize according to soil tests. Prevention of erosion and conservation of water through contour farming, including stripcropping, are needed. Also, erosion should be controlled on long slopes by diverting surface water to safe channels. These soils need the protection of a rotation that provides a fairly high proportion of close-growing crops. The most intensive rotation that should be considered consists of a row crop, winter cover crop, row crop, winter cover crop, spring grain, and hay. More desirable rotations are (1) row crop, winter cover crop, spring grain, and hay; or (2) row crop, winter cover crop, spring grain, winter grain, and 2 years of hay.

CAPABILITY UNIT IIe–2

Capability unit IIe–2 consists of only one soil, Pope fine sandy loam, 5 to 8 percent slopes. This soil occurs on moderately sloping flood plains and deltas. It is a deep, well-drained, moderately coarse textured soil, moderately permeable to water and only moderate in water-supplying capacity. It is naturally acid and moderately low in plant nutrients.

Use suitability and management needs.—This soil is well suited to general farm crops or to pasture. Occasional stream overflow, however, may have considerable scouring effect. The soil needs the protection of close-growing vegetation during winter and spring and should be plowed for tilled crops just before they are planted.

CAPABILITY UNIT IIe–3

Moderately deep, well-drained, medium-textured upland soils are in capability unit IIe–3. These soils have good structure and are moderately permeable to water. They have moderate water-supplying capacity. They were derived from a mixture of shale, sandstone, and a little limestone. They are less acid and a little higher in plant nutrients than other soils of the county.

The soils in capability unit IIe–3 are:

Westmoreland silt loam, 0 to 5 percent slopes.
Westmoreland silt loam, 5 to 12 percent slopes.

Use suitability and management needs.—These soils are well suited to all farm crops of the area, but they are especially favorable for pasture and for alfalfa and other hay crops. Although partly derived from limestone, they are normally somewhat acid and should be tested to determine their needs for lime. Where heavily farmed, the plant nutrients are generally depleted. The soils respond to a complete fertilizer.

Most of these soils are sloping. They need erosion control and water conservation, which can be accomplished by contour farming and particularly by contour stripcropping. Also, excess surface water should be diverted from long slopes to protected channels before it reaches these soils. Rotations similar to those used for capability unit IIe–1 are suitable for this unit, but good yields of hay and easy maintenance of good stands make it desirable to use these soils for hay more of the time.

CAPABILITY UNIT IIe–4

In capability unit IIe–4 are nearly level to moderately sloping, shallow, well-drained shaly soils. These soils have a moderately low to low water-supplying capacity. They are naturally acid and are low in plant nutrients.

The soils in capability unit IIe–4 are:

Gilpin shaly silt loam, 0 to 5 percent slopes.
Gilpin shaly silt loam, 5 to 12 percent slopes.

Use suitability and management needs.—These soils are moderately well suited to general farm crops, but summer drought often checks growth. In many seasons oats, buckwheat, corn, and the second cutting of hay do not yield well.

Because the volume of soil available for root growth is small, and because water is so often the limiting factor in crop growth, frequent moderate-sized applications of lime and fertilizer are usually more efficient than very heavy treatments used less frequently.

Water conservation, erosion control, and maintenance of soil organic matter are important. Contour stripcropping, combined with a rotation that has only 1 year of row crops in 3 or 4, is desirable.

CAPABILITY UNIT IIe–5

In capability unit IIe–5 are nearly level to moderately sloping, moderately deep, well-drained soils. They are medium to moderately coarse textured soils that have developed on sandstone. They have weak structure but are permeable to water. They have moderate to low moisture-supplying capacity and are acid and low in plant nutrients.

The soils in capability unit IIe–5 are:

Dekalb channery loam, 0 to 5 percent slopes.
Dekalb channery loam, 5 to 12 percent slopes.
Dekalb channery sandy loam, 0 to 5 percent slopes.
Dekalb channery sandy loam, 5 to 12 percent slopes.
Dekalb loam, 0 to 5 percent slopes.
Dekalb loam, 5 to 12 percent slopes.

Use suitability and management needs.—All of these soils are moderately well suited to general farm crops. They are favorable for crops, especially potatoes. Their acidity and low natural fertility make yields low, unless their needs for lime and fertilizer are met. For crops such as corn, these soils have the disadvantage of occurring mostly in the northeastern part of the county where the frost-free growing season is a little shorter than in the southern part. Potatoes and oats are favored by the slightly cooler climate.

Careful attention to maintaining soil fertility and organic matter is very important. For the more sandy soils, frequent applications of lime and fertilizer are needed. The nearly level soils present only a slight erosion hazard, particularly where there are many coarse sandstone fragments on the surface and where organic-matter content is high. On the gently to moderately sloping soils, there is moderate erosion hazard, and contour stripcropping is needed to control erosion and conserve water. On some long slopes diversion of excess surface water will help to reduce erosion.

CAPABILITY UNIT IIe–6

In capability unit IIe–6 are gently sloping, deep, moderately well drained, medium-textured soils. They have fairly good structure and permeability in the surface soil and upper subsoil. The lower subsoil is compact, usually somewhat heavier than the upper subsoil, and slowly permeable. The lower subsoil shows mottling, which indicates poor drainage in this part of the soil. The soil above the lower subsoil is usually well drained but in very wet seasons becomes temporarily waterlogged. Cavode silt loam, concretionary variant, has somewhat poorer drainage than any of the other soils in the group.

All of the soils of this unit except Cavode silt loam, concretionary variant, are naturally acid and moderately low in plant nutrients. The concretionary Cavode soil is naturally less acid and somewhat higher in nutrients.

The soils in capability unit IIe–6 are:

Cavode silt loam, concretionary variant, 2 to 8 percent slopes.
Cookport channery loam, 2 to 8 percent slopes.
Cookport channery silt loam, 2 to 8 percent slopes.
Cookport silt loam, 2 to 8 percent slopes.
Ernest silt loam, 0 to 8 percent slopes.
Monongahela silt loam, 2 to 8 percent slopes.
Sciotoville silt loam, 2 to 8 percent slopes.
Wharton silt loam, 2 to 8 percent slopes.

Use suitability and management needs.—The soils of unit IIe–6 are well suited to corn, oats, hay crops, and pasture. They are only moderately well suited to alfalfa and to winter grains. In some years these crops are excessively damaged by winterkilling. Potato crops are uncertain. In some years they are good. In others, when soil moisture is excessive after planting or before harvest, the crop is poor.

The soils of this unit should be limed and fertilized according to needs shown by soil tests and to the requirements of the crops to be grown.

Artificial drainage normally is not needed. Spot drainage of small areas affected by seepage or accumulation of surface water is desirable. Surface runoff is somewhat greater on these soils than on the well-drained soils because these soils have a tight layer in the lower subsoil. Diversion of excess surface water to protected channels will reduce erosion and prevent concentration of water on lower areas. For effective control of erosion and efficient management of water, stripcropping should be on a slight but definite grade, that is, a grade that will prevent ponding between rows without causing erosion. Crop rotations should consist of row crops, winter cover crops, spring grains, and hay. Winter grains occasionally may be used where the soil structure is good and the soil fertility is fairly high. A surface mulch is also helpful where winter grain is grown.

CAPABILITY UNIT IIw–1

In capability unit IIw–1 are deep, moderately well drained, medium-textured soils. These soils have fairly good structure and permeability in the surface soil and upper subsoil. The lower subsoil is compact, usually somewhat finer textured than the material above, and slowly permeable. The mottling in the lower subsoil indicates seasonal poor drainage. The Cavode soil has somewhat poorer drainage than the other soils in the group.

The location of these soils, mostly on nearly level areas, causes slow surface drainage. The soils are naturally acid and have a moderately low supply of plant nutrients. Cavode silt loam, concretionary variant, is naturally less acid and somewhat higher in nutrients than the other soils.

The soils in capability unit IIw–1 are:

Cavode silt loam, concretionary variant, 0 to 2 percent slopes.
Cookport channery silt loam, 0 to 2 percent slopes.
Cookport silt loam, 0 to 2 percent slopes.
Monongahela silt loam, 0 to 2 percent slopes.
Sciotoville silt loam, 0 to 2 percent slopes.
Wharton silt loam, 0 to 2 percent slopes.

Use suitability and management needs.—The soils of unit IIw–1 are very well suited to corn, oats, hay crops, and pasture. Winter grains and alfalfa are only moderately well suited, as they are often subject to winterkilling. Potato crops are frequently damaged by excess water. Ponding between rows is difficult to avoid when row crops are grown.

Lime and fertilizer should be applied according to soil tests and the requirements of the crops to be grown. Surface drainage is needed in some low spots. Other low spots need tile drainage. Both types of drainage are often hard to install because the land is so nearly level. Diversion of excess surface water from higher lands, before it reaches these flat areas, is in many places the most effective drainage improvement. Crop rotations should feature row crops, winter cover crops, spring grains, and hay. Winter grains may be used where surface water does not pond and the soil structure is good. Heaving and winterkilling can be reduced by maintaining high fertility and providing a surface mulch.

CAPABILITY UNIT IIw–2

Capability unit IIw–2 consists of nearly level, deep, moderately well drained, medium or moderately coarse textured soils of the flood plains. These soils have little structure but are permeable to water and have a moderate to moderately high moisture supply. Flooding ranges from occasional to frequent, according to characteristics of the local stream. The period of flooding is normally short and often occurs when crops can withstand the wetness. In some seasons the water table is not far below the surface for periods of several weeks. These soils are naturally acid but sometimes receive plant nutrients in floodwaters and deposits of silt.

The soils in capability unit IIw–2 are:

Philo fine sandy loam, 0 to 6 percent slopes.
Philo silt loam, 0 to 6 percent slopes.

Use suitability and management needs.—The soils of unit IIw–2 are well suited to pasture, hay, corn, and oats. When cropped, they need only ordinary good farming practices, including the use of lime and fertilizer in amounts shown by soil tests. Also, crops should be only those that are not injured by occasional high water. Along some streams it is possible to lower the water table and improve drainage. Pastures on these soils are injured by trampling if they are grazed when wet. For best pasture production, grazing should be rotated. Grazing should be avoided when the soils are wet, as the trampling packs down the soil and cuts up the sod.

CAPABILITY UNIT IIIe–1

In capability unit IIIe–1 are moderately sloping to moderately steep, mostly shallow to moderately deep, medium-textured soils. These soils have good structure and are at least moderately permeable to water. They generally have moderate water-supplying capacity. Some of the severely eroded phases and the Gilpin shaly silt loams have low water-supplying capacity.

The soils of this capability unit are naturally acid and have only a moderate supply of plant nutrients. The variant of Wharton silt loam included in this unit is not quite so well drained, is less permeable, and is less acid than the other members of the unit. The soils that are severely eroded are normally lower in organic matter and have poorer structure than other soils in the unit.

The soils in capability unit IIIe–1 are:

Clymer channery loam, 12 to 25 percent slopes.
Gilpin channery loam, 12 to 25 percent slopes.
Gilpin channery loam, 12 to 25 percent slopes, severely eroded.
Gilpin channery silt loam, 12 to 25 percent slopes.
Gilpin channery silt loam, 12 to 25 percent slopes, severely eroded.
Gilpin shaly silt loam, 5 to 12 percent slopes, severely eroded.
Gilpin shaly silt loam, 12 to 25 percent slopes.
Gilpin silt loam, 12 to 25 percent slopes.
Gravelly terraces, 12 to 25 percent slopes.
Holston silt loam, 8 to 15 percent slopes.
Rayne silt loam, 12 to 25 percent slopes.
Shelocta silt loam, 8 to 15 percent slopes.
Wharton silt loam, concretionary variant, 12 to 30 percent slopes, eroded.
Wharton silt loam, 8 to 15 percent slopes.
Wheeling gravelly loam, 8 to 15 percent slopes.
Wheeling silt loam, 8 to 15 percent slopes.

Use suitability and management needs.—When the field survey legend was set up for Clarion County and the mapping started, much of the farming was still being done with horse-drawn equipment. Since then the conversion to tractor power has been almost complete. The stronger slopes on many of these soils are above the safe range for most tractors when they are operated on the contour. Therefore, slopes above 20 percent should be excluded from the following recommendations and treated according to those given for capability unit IVe–1.

The soils of unit IIIe–1 are fairly well suited to the whole range of crops grown in this area. The difficulties of cultivating, spraying, and harvesting make all but the least sloping parts of these soils undesirable for potatoes and vegetable crops. The stronger slopes are, nevertheless, well suited to pasture. Pastures can be improved and intensively managed with machinery.

Lime and fertilizer should be applied according to soil tests and the requirements of the crops to be grown. Contour stripcropping will help prevent erosion and conserve water. Both water conservation and erosion control are vitally needed on these soils. Surface water should be diverted from long slopes. In many places the diversion channels can be made on the less steep slopes of higher lying soils. The soils of this unit need the protection of rotations that have not more than one row crop and at least two hay crops in 4 years. Rotations should be no more intensive than (1) corn, winter cover crop, spring grain, and 2 years of hay; or (2) corn, winter cover crop, oats, wheat, and 2 years of hay. Organic matter should be maintained to keep good soil structure and to avoid surface crusting. Mulching and the return of crop residues are desirable. Careful management, including liming, fertilizing, rotation of grazing, and destroying weeds, will produce the most productive pasture on these soils.

CAPABILITY UNIT IIIe–2

Only one soil, Westmoreland silt loam, 12 to 25 percent slopes, is in capability unit IIIe–2. It is a moderately steep, moderately deep to shallow, well-drained, medium-textured soil of the upland that was derived from a mixture of shale and sandstone and a little limestone. It is moderately permeable to water and has good structure and a moderate to moderately low moisture supply. It is less acid and higher in plant nutrients than the soils of capability unit IIe–1.

Use suitability and management needs.—This soil is especially suitable for pasture and for hay crops, including alfalfa. Management can be similar to that for capability unit IIIe–1.

CAPABILITY UNIT IIIe–3

Capability unit IIIe–3 consists of moderately steep, moderately deep to shallow, medium to moderately coarse textured soils that overlie sandstones. These soils have open permeable structure and a moderate or moderately low moisture supply. They are acid and

moderately low in plant nutrients. The Dekalb channery sandy loam has a little lower supply of plant nutrients and a lower moisture-supplying capacity than the others.

The soils in capability unit IIIe–3 are:

Dekalb channery loam, 12 to 25 percent slopes.
Dekalb channery sandy loam, 12 to 25 percent slopes.
Dekalb loam, 12 to 25 percent slopes.

Use suitability and management needs.—The following general recommendations do not apply to areas on the uppermost slopes on these soils, because they are above the limit for safe operation of farm tractors. These steepest areas should be kept in grass, or if it is impractical to graze them or harvest hay, they may be planted to trees.

The general recommendation for these soils of unit IIIe–3 is to use a rotation that has only one row crop in 5 years; for example, a row crop, winter cover crop, spring grain, winter grain, and 2 years of hay. Farming should be done on the contour to conserve water and should include contour stripcropping. To protect long slopes, excess surface water should be diverted before it reaches these soils. Organic matter should be conserved by return of crop residues and application of manure. Frequent moderate applications of lime and fertilizer are needed to promote vigorous vegetation and good crops. The amounts used should be based on soil tests and the needs of the crop to be grown. When the soils are used for pasture, care is necessary to maintain soil fertility.

CAPABILITY UNIT IIIe–4

Moderately sloping, deep, moderately well drained, medium-textured soils are in capability unit IIIe–4. They have fairly good structure and permeability in the surface soil and upper subsoil. The lower subsoil is compact, is normally somewhat heavier, and is slowly permeable. It shows mottling, which indicates seepage or seasonal poor drainage.

These soils have a moderate to moderately high moisture-holding capacity. They are naturally acid and moderately low in plant nutrients. The concretionary variant of Cavode silt loam is less acid and a little higher in nutrients than other members of the unit.

Ernest silt loam, 0 to 8 percent slopes, severely eroded phase, is an exception to much of the above. It occurs on gentle slopes, has poorer surface structure and permeability than the others, and has less moisture-supplying capacity. Concentration of surface water has caused more erosion hazard than is normal for gentle slopes. Therefore, this soil has the same management needs as the other soils of this unit, even though it has milder slopes.

The soils in capability unit IIIe–4 are:

Cavode silt loam, concretionary variant, 8 to 15 percent slopes.
Cookport channery loam, 8 to 15 percent slopes.
Cookport channery silt loam, 8 to 15 percent slopes.
Cookport silt loam, 8 to 15 percent slopes.
Ernest silt loam, 0 to 8 percent slopes, severely eroded.
Ernest silt loam, 8 to 15 percent slopes.
Monongahela silt loam, 8 to 15 percent slopes.
Sciotoville silt loam, 8 to 15 percent slopes.
Wharton silt loam, 8 to 15 percent slopes.

Use suitability and management needs.—These soils are suited to pasture and to many kinds of crops. Use of winter grains is sometimes worthwhile, but they, as well as alfalfa, are subject to damage by winterkilling, for the soils are seasonally wet and drainage is somewhat slow. Danger from winterkilling is less if the supply of organic matter is high and the soil structure is good. In some seasons potatoes are damaged by prolonged wetness of the surface soil. When cropped, these soils should be limed and fertilized according to needs shown by soil tests and with consideration of needs of the crop to be grown. A rotation should be used that maintains organic matter and good soil structure. On the more eroded spots special attention to the addition of crop residues and manure will help to restore organic matter and soil structure. A rotation should not include more than one row crop in 4 years. A suitable rotation is a row crop, winter cover crop, spring grain, and 2 years of hay. If hay is planned for more than 2 years, a legume that can withstand seasonal wetness and resist winterkilling should be used.

Some wet spots included in larger areas of these soils may be drained by either tile or open drains. This will make the entire area easier to till. Because surface runoff is frequently high, diversion of excess surface water is needed to improve drainage of low spots and to reduce erosion. Row crops should be planted on a definite slight grade that slopes toward safe, natural or constructed, waterways. Stripcropping generally should be on a slight grade.

Pastures need to be well limed and fertilized. They should be protected from grazing early in spring and in other seasons when they are very wet.

CAPABILITY UNIT IIIe–5

The soils in capability unit IIIe–5 are gently to moderately sloping, moderately deep, and somewhat poorly drained. They are medium-textured soils and have fairly well developed structure, but their tight clay subsoil is densely packed and slowly permeable to water. The moisture supply is moderate. These soils are naturally acid and have a moderately low supply of plant nutrients.

The soils in capability unit IIIe–5 are:

Cavode channery silt loam, 2 to 8 percent slopes.
Cavode channery silt loam, 8 to 15 percent slopes.
Cavode silt loam, 2 to 8 percent slopes.
Cavode silt loam, 8 to 15 percent slopes.

Use suitability and management needs.—The soils of unit IIIe–5 are well suited to spring grains, hay, and pasture. They are fairly well suited to corn. Winter grains are likely to winterkill, but there is less chance of this where the fertility has been built up and the supply of organic matter is maintained.

Liming and fertilizing should be done according to soil tests and the requirements of the crops to be grown. Returning crop residues and manure to these soils whenever possible will provide mulch and protect the structure of the surface soil. The most intensive rotation should be a row crop, winter cover crop, spring grain, and 2 years of hay. Rotations that have an even longer time in hay are desirable. The danger of winter-

killing makes resistant legumes preferable. Because surface runoff is rapid, excess surface water should be diverted from slopes to reduce erosion and improve drainage. Stripcropping and tillage of row crops should be on a slight but definite grade to prevent ponding between rows or in finishing furrows. The slope of the strips should not be enough to allow serious erosion.

CAPABILITY UNIT IIIe–6

Gently sloping, shallow to moderately deep, poorly drained, medium-textured soils make up capability unit IIIe–6. The surface soil normally has good structure, but the subsoil is dense and slowly permeable. Although these soils are too wet much of the time, their moisture-supplying capacity is low because the root zone for crop plants is so shallow. These soils are naturally acid. They vary in the supply of plant nutrients. Generally leaching has not been so severe on these soils as on the better drained soils. The severely eroded phase of Armagh silt loam, 2 to 8 percent slopes, is shallower and lower in organic matter than the other soils of this unit.

The soils in capability unit IIIe–6 are:

Armagh silt loam, 2 to 8 percent slopes.
Armagh silt loam, 2 to 8 percent slopes, severely eroded.
Brinkerton silt loam, 2 to 10 percent slopes.
Nolo silt loam, 2 to 10 percent slopes.
Tyler silt loam, 2 to 10 percent slopes.

Use suitability and management needs.—Without artificial drainage these soils are poorly suited to crops or improved pasture. With a moderate amount of drainage, they are fair for crops and fairly good for pasture; but because they are so shallow to a tight subsoil or hardpan, it is very difficult to establish good enough drainage for winter grains or a deep-rooted crop such as alfalfa. The most intensive rotation recommended consists of a row crop, winter cover crop, spring grain, and 2 years of hay.

These soils should be limed and fertilized according to needs shown by soil tests and with consideration of the crop to be grown. Special attention should be given to restoring organic matter and soil structure to the severely eroded phase of Armagh silt loam. Returning crop residues and manure to the surface will help do this. When used for pasture, soils of this unit should be well limed and fertilized. Grazing should be restricted to dry weather. Weed control in pastures is fairly difficult.

Diversions and drainage terraces at close intervals help remove excess surface water and some of the water that seeps through the soil just above the tight subsoil. Spots kept wet all the time by springs or seeps can be tile drained.

CAPABILITY UNIT IIIw–1

Nearly level, poorly drained, medium-textured soils make up capability unit IIIw–1. The surface soils have fairly good structure, but the tight subsoils are dense and slowly or very slowly permeable. Although water is often ponded in wet weather, the moisture-storing capacity of the soils is moderately low because the root zone is shallow for most crop plants. These soils are acid and moderately low in plant nutrients.

The soils in capability unit IIIw–1 are:

Armagh silt loam, 0 to 2 percent slopes.
Brinkerton silt loam, 0 to 2 percent slopes.
Ginat silt loam, 0 to 5 percent slopes.
Nolo silt loam, 0 to 2 percent slopes.
Tyler silt loam, 0 to 2 percent slopes.

Use suitability and management needs.—The slow permeability of the subsoils and nearly level relief make drainage a serious problem. Without artificial drainage, these soils are not suitable for crops or improved pasture. With drainage they are only fair for crops and pasture. The most intensive rotation should have a row crop or buckwheat only 1 year in 4. A suitable rotation is a row crop, winter cover crop, spring grain, and 2 years of hay. In some years unfavorable weather will prevent establishment of a winter cover crop.

Where cropped, these soils should be limed and fertilized according to soil tests and the requirement of the crop to be grown. But even with artificial drainage and good fertility practices, yields are seldom high. Only crops tolerant of a wet soil should be grown. Where these soils are pastured, only grasses and legumes that can withstand some flooding or waterlogging should be used. Pasture should be well limed and fertilized, and grazing should be limited to dry weather.

The shallow depth to the slowly permeable subsoil makes tile drainage very slow in removing excess water. Tile drainage is effective, however, for some of the low spots. The first step in improving drainage is to divert surface water to channels before it reaches these nearly level soils. Regrading the surface in beds or lands that slope gently toward broad shallow channels is sometimes the most effective method of drainage. This bedding requires careful layout and management; otherwise, ponded areas will prevent full use of the land.

CAPABILITY UNIT IIIw–2

Capability unit IIIw–2 consists of only one soil, Cavode silt loam, 0 to 2 percent slopes. This nearly level, moderately deep, and somewhat poorly drained soil is medium textured and has a tight clay subsoil. Near the surface the structure is fairly good, but the lower subsoil is dense and slowly permeable. The strong mottling in the subsoil indicates a seasonal high water table. The entire soil is naturally acid and moderately low in plant nutrients.

Use suitability and management needs.—The soil in this unit is fairly well suited to corn, buckwheat, spring grains, hay, and pasture. Crop rotations and fertility practices should be the same as for the soils of capability unit IIIe–5.

Drainage is a somewhat more difficult problem than for the more sloping soils of capability unit IIIe–5. In some places the solution is to divert water on higher areas before it reaches this soil. Some areas need regrading to provide a gentle slope toward broad shallow surface channels. This grading requires careful layout to avoid ponding in low spots.

Where the soil is used for pasture, some surface drainage is normally needed to grow good sod-forming grasses and legumes that are not easily damaged by trampling.

CAPABILITY UNIT IVe–1

The soils in capability unit IVe–1 are moderately steep to steep, shallow to deep, well drained, and medium to coarse textured. Their structure is fairly good, and they are porous and permeable. The moisture supply varies from low to moderate. These soils are naturally acid and moderately low in plant nutrients. Westmoreland silt loam, 25 to 35 percent slopes, eroded, is less acid and more fertile than other members of the group. Wheeling silt loam and Gravelly terraces are deep, but a high proportion of sand and gravel in the lower part makes their water supply comparable to that of the other soils in the unit.

The soils in capability unit IVe–1 are:

Gilpin soils, 25 to 35 percent slopes.
Gravelly terraces, 25 to 45 percent slopes.
Westmoreland silt loam, 25 to 35 percent slopes, eroded.
Wheeling silt loam, 15 to 25 percent slopes.

Use suitability and management needs.—The soils of unit IVe–1 have wide range in slope. They are in one capability unit mainly because of similar erosion hazard. The steeper soils are too steep for practical operation of farm machinery and may best be used for pasture. The general adaptation is to hay and pasture. Where plowing is possible, reseeding of pastures may be done with a small grain as a nurse crop. Row crops should always be avoided on these soils.

For either hay or pasture, lime and fertilizer should be used according to soil tests and the needs of the grasses and legumes that are being grown. Seeding mixtures should include long-living, hardy, perennial grasses and legumes, as well as some plant that will quickly provide a cover to prevent erosion. Pastures should be topdressed at intervals to maintain good growth.

CAPABILITY UNIT IVe–2

In capability unit IVe–2 are moderately steep and steep, shallow to moderately deep, well-drained, medium to moderately coarse textured soils. These soils are porous and permeable to water. They have a moderately low moisture supply and are naturally acid and low in plant nutrients. The severely eroded phases have moderately steep slopes, but erosion has reduced their depth to less than that normal for other soils on similar strong slopes.

The soils in capability unit IVe–2 are:

Dekalb channery loam, 12 to 25 percent slopes, severely eroded.
Dekalb channery loam, 25 to 35 percent slopes.
Dekalb channery sandy loam, 12 to 25 percent slopes, severely eroded.
Dekalb channery sandy loam, 25 to 35 percent slopes.

Use suitability and management needs.—These soils are only moderately well suited to hay and pasture. Hay is difficult to manage and harvest on steep slopes. On moderately steep slopes harvesting is easier, but fertility is more difficult to maintain because the soil is eroded. Row crops are not suitable on these soils. Long-term hay should be reseeded with a small grain. The seeding should be done in strips across the slope, and as soon as possible after plowing. Grasses and legumes that can make a good sod in spite of drought should be used. In reseeding pasture, a grass that makes rapid growth should be included to provide the quick cover that will check erosion.

These soils should be limed and fertilized according to needs shown by soil tests. Because the soils leach rapidly and have a low capacity for holding nutrients, frequent moderate applications of fertilizer are best for maintaining productivity. Special effort should be made to restore organic matter to the severely eroded soils.

CAPABILITY UNIT IVe–3

In capability unit IVe–3 are gently sloping to moderately steep, moderately well drained, and somewhat poorly drained, medium-textured soils. All of these soils have tight slowly permeable subsoils that show mottling. The mottles indicate that the soils are wet part of the time. The soils have a moderate moisture supply, are naturally acid, and have a moderate to moderately low supply of plant nutrients. The severely eroded phases are generally low in organic matter.

The soils in capability unit IVe–3 are:

Cavode silt loam, 2 to 8 percent slopes, severely eroded.
Cavode silt loam, 8 to 15 percent slopes, severely eroded.
Cavode silt loam, 15 to 25 percent slopes.
Cookport channery silt loam, 15 to 30 percent slopes.
Ernest silt loam, 8 to 15 percent slopes, severely eroded.
Ernest silt loam, 15 to 30 percent slopes.
Monongahela silt loam, 15 to 25 percent slopes.
Wharton silt loam, 15 to 25 percent slopes.

Use suitability and management needs.—The soils of capability unit IVe–3 are only fairly well suited to small grains, hay, and pasture. The severely eroded soils have poor soil structure. The moderately steep soils are not suitable for row crops because of rapid runoff and serious erosion hazard. In general they should be used for long-term hay, and hay crops should be reseeded with a small grain. If hay crops have been good for several years, soil structure is usually improved to a point that growing a row crop 1 year will not entirely destroy the structure of the soils. Normally a small grain should be seeded immediately after the soil is plowed, but if the surface soil becomes puddled, it is very difficult to prepare a good seedbed. Crops should be grown that can withstand, for several years, rather severe contrasts of wetness and drought. Alfalfa frequently freezes out on these soils.

Lime and fertilizer should be applied according to soil tests and the requirements of the crops to be grown. Cultivation should be across the slope. Runoff should have a definite gradual flow toward natural or constructed waterways. In many places gullies first will have to be filled or smoothed. Some areas that are kept wet by wet-weather springs need to be drained so that normal tillage can be practiced. Surface water should be diverted from slopes to protected channels.

CAPABILITY UNIT VIe-1

The two soils in capability unit VIe–1 are moderately steep and steep, severely eroded, shallow, and well drained. They are permeable to water but have a low water-supplying capacity. They are naturally acid and moderately low in natural fertility. They are normally low in organic matter.

The soils in capability unit VIe–1 are:

Gilpin shaly silt loam, 12 to 25 percent slopes, severely eroded.
Gilpin soils, 25 to 35 percent slopes, severely eroded.

Use suitability and management needs.—Pasture or forest is the most practical use for these soils. If they are used for pasture, drought-resistant grasses and legumes should be seeded. They should be limed and fertilized according to needs shown by soil tests. Brush should be killed. For reforestation, the drought-resistant kinds of trees are most suitable.

CAPABILITY UNIT VIe-2

The only soil in capability unit VIe–2, Cavode stony silt loam, 15 to 30 percent slopes, is moderately steep, moderately deep, and somewhat poorly drained. It is medium textured but too stony for cultivation. The subsoil is slowly permeable.

Use suitability and management needs.—Wooded areas on this soil normally remain in that use. Areas that are already cleared can provide fair pasture. Grasses and legumes that tolerate a moderately wet soil are best suited. The soil should be limed and fertilized according to soil tests. Some boulders may need to be removed before machinery can be used to spread lime and fertilizer and to mow weeds.

CAPABILITY UNIT VIe-3

In capability unit VIe–3 is one soil, Armagh silt loam, 8 to 15 percent slopes. It is moderately sloping, poorly drained, and medium textured. It is shallow to a tight clay subsoil, is slowly permeable, and loses surface water rapidly. It is naturally acid and moderately low in plant nutrients.

Use suitability and management needs.—This soil is fairly well suited to wetland grasses. If used for pasture, it should be limed and fertilized according to needs shown by soil tests. In many places seeps or surface runoff from higher areas help cause the wetness. This water should be intercepted wherever possible. Grazing should be limited to dry seasons.

CAPABILITY UNIT VIs-1

In capability unit VIs–1 are gently to moderately sloping, deep, moderately well drained to somewhat poorly drained soils. These soils have good structure in the surface soil and upper subsoil, but the lower subsoil is tight and slowly permeable to water. The moisture supply is moderately high. The soils are naturally acid and moderately low in plant nutrients.

The soils in capability unit VIs–1 are:

Cookport stony silt loam, 0 to 15 percent slopes.
Ernest stony silt loam, 2 to 15 percent slopes.

Use suitability and management needs.—These soils make moderately good pasture if they are limed and fertilized according to needs shown by soil tests. Removal of some surface boulders generally makes it easier to apply lime and fertilizer and to mow the weeds. Grazing should not start until the soil has dried in the spring.

CAPABILITY UNIT VIw-1

The soils of capability unit VIw–1 are poorly and very poorly drained, medium textured, and level to moderately sloping. Their structure is generally good, but tight subsoil layers or continual seepage keeps the soils waterlogged most of the time. These soils are naturally acid and moderate to low in natural fertility. All but the two Lickdale silt loams are too stony to cultivate. Cavode stony silt loam, 2 to 15 percent slopes, is a little better drained than other members of the unit.

The soils in capability unit VIw–1 are:

Armagh stony silt loam, 0 to 8 percent slopes.
Brinkerton stony silt loam, 0 to 8 percent slopes.
Cavode stony silt loam, 2 to 15 percent slopes.
Lickdale silt loam, 0 to 2 percent slopes.
Lickdale silt loam, 2 to 10 percent slopes.
Lickdale stony silt loam, 0 to 8 percent slopes.
Nolo stony silt loam, 0 to 8 percent slopes.

Use suitability and management needs.—If used for pasture, these soils should be seeded with grasses that can withstand much wetness. Where stones do not prevent operation of machinery, the soils should be limed and fertilized in dry seasons. In places, open drains remove enough surface water to allow improving the pastures by applying lime and fertilizer and mowing weeds. The combined stoniness and poor drainage make digging of ditches difficult, but in some places surface runoff or seepage from higher areas can be diverted to ditches before the water reaches these soils. Too heavy grazing will cause some damage, for the soils are too wet to withstand much trampling.

CAPABILITY UNIT VIw-2

A nearly level soil of the flood plain, Atkins silt loam, 0 to 5 percent slopes, is in capability unit VIw–2. The soil is deep, poorly drained, and medium textured. Ground water stays close to the surface for long periods. The soil is naturally acid.

Use suitability and management needs.—Overflow from streams usually occurs too frequently to allow effective drainage of this soil for crops. It makes fair dry-season pasture if it is limed and fertilized according to soil tests. For productive pasture, it is necessary to keep weeds and brush cut.

CAPABILITY UNIT VIIe-1

In capability unit VIIe–1 are very steep soils, steep stony soils, steep severely eroded soils, and stony shallow soils on moderate slopes. These soils range from well drained to somewhat poorly drained. Their moisture supply is moderate to low.

The soils in capability unit VIIe–1 are:

Cavode silt loam, 15 to 25 percent slopes, severely eroded.
Cavode silt loam, 25 to 35 percent slopes, eroded.
Cookport stony silt loam, 15 to 30 percent slopes.
Dekalb stony loam, 0 to 25 percent slopes.
Dekalb stony loam, 25 to 35 percent slopes.
Dekalb stony loam, 35 to 75 percent slopes.
Ernest stony silt loam, 15 to 30 percent slopes.
Gilpin stony silt loam, 0 to 25 percent slopes.
Gilpin stony silt loam, 25 to 60 percent slopes.
Gilpin soils, 35 to 60 percent slopes.
Gilpin soils, 35 to 60 percent slopes, severely eroded.

Use suitability and management needs.—These soils are unsuitable for crops and are difficult to manage as pasture. They are mostly good for forest and should be managed for heavy forest production.

CAPABILITY UNIT VIIe–2

The soils of capability unit VIIe–2 are very steep, stony, or steep and severely eroded, well drained, and medium to moderately coarse textured. The moisture supply is low to moderately low. The soils are acid and very low in fertility.

The soils and miscellaneous land types in capability unit VIIe–2 are:

Dekalb channery loam, 25 to 35 percent slopes, severely eroded.
Dekalb channery loam, 35 to 60 percent slopes.
Dekalb channery sandy loam, 35 to 60 percent slopes.
Leetonia stony sandy loam, 0 to 25 percent slopes.
Leetonia stony sandy loam, 25 to 60 percent slopes.
Made land.
Strip mine spoil.

Use suitability and management needs.—These soils and land types are unsuitable for crops and pasture because of stoniness and steepness of slope or because of the poor soil material in the Made land and the Strip mine spoil. They are fair to moderately poor for forest. The Leetonia soils are poor for all forest trees except white pine and hemlock. Strip mine spoil is somewhat difficult to reforest because of the poor condition and temporarily strong acidity of some of the material.

CAPABILITY UNIT VIIIs–1

Capability unit VIIIs–1 consists of miscellaneous land types that will not support normally productive crops, pasture, or forest vegetation. The loose gravel or hard rock floors in the Gravel pits afford little basis for vegetation. Mine dumps also are poor for plant growth because the material has a high content of waste coal and carbonaceous shales or cinders and ash.

The miscellaneous land types in capability unit VIIIs–1 are:

Gravel pits.
Mine dumps.

Use suitability and management needs.—Grasses tolerant of poor soil material, shrubs, vines, and finally trees gradually become established on these areas. Revegetation may be speeded up by seeding. Where wash from these areas damages other land, mulching may sometimes be used to help establish vegetation.

Management of cropland, pasture, and woodland

Cropland.—These principles of management apply to all soils used as cropland: (1) Crops are selected to suit the soil and climate; (2) fertilizer and lime are applied in amounts that will produce good yields; (3) the supply of organic matter is maintained by using crop rotations that include grass, by conserving stubble, straw, and other crop residues, and by applying manure; (4) contour tillage or similar practices are applied for control of runoff and erosion (fig. 4);

FIGURE 4.—Stripcropping on Gilpin soils.

and (5) artificial drainage is provided for wet areas.

Pasture.—These principles of management apply to all soils used for pasture: (1) Needs for lime and fertilizer are met; (2) grazing is regulated to keep a good sod on the land; (3) cattle are kept off pastures when they are so wet that trampling may compact them; (4) weeds and brush are controlled; and (5) run-down pastures are renovated by overseeding or reseeding.

Woodland.—There are two main kinds of wooded areas in Clarion County, the farm woodlands, which occupy a small acreage on nearly every farm; and the extensive forested areas held in large private tracts or owned by the State.

LARGE FOREST AREAS.—Practically all the large wooded tracts are State forest or game land, or they are owned by pulpwood companies, or by power companies as watersheds. Ordinarily, these areas are not suitable for crops or pasture. The exceptions are some leased fields and parts of the State game lands that are cropped to furnish food for wildlife.

The relative suitability of the various soils in the large wooded areas is not taken into account in their present use. Nevertheless, in planning future use of these large areas, a knowledge of the soils is advantageous. Woodland management will be more efficient if the species of trees planted or preserved during cutting are those suited to the soils. If the trees are suitable to the soils, the stand will require little management, will be productive, and will reseed voluntarily. Furthermore, data on experimental planting or other data can be transferred from one area of a given kind of soil to another by use of a soil map.

Soil maps are also useful in locating roads for economical construction and maintenance. They show poorly drained areas so that they can be avoided or crossed by the most direct route. They indicate where road fill and surfacing materials can be found, and they show how skid trails and side roads can be placed so as to avoid starting gullies.

A knowledge of soils will aid in fire control. The shallower soils, especially on the ridges and steep slopes, dry out sooner and have a longer danger period than the deep soils and poorly drained soils.

FARM WOODLOTS.—Nearly every farm has a woodlot. Generally it is small and is on land that would be difficult to use for crops because of steepness, stoniness, or poor drainage. Only a few woodlots are on the better soils, and normally they have been kept as a source of forest products for the farm or as a windbreak for fields and buildings.

Many of the woodlots are not fenced out from pasture or from cropland that is sometimes grazed. These woodlots provide little forage. Besides, the browsing destroys seedling trees and thus stops regrowth. Even more serious is the trampling of the grazing animals, which destroys the surface mat of organic matter that holds most of the fine tree roots. Prolonged trampling leaves the soil bare and very compact. Water runs off instead of soaking into the soil, runoff increases, and erosion becomes serious.

The methods of harvesting vary and could be much improved. Sometimes the standing timber is sold for clear cutting. After this kind of cutting, the woodlot will have little value for a generation. Some farmers practice a "high-grading"; that is, they cut the better trees as they mature. This kind of cutting leaves only the less desirable trees to grow to maturity.

Full management of farm woodlots is hindered by lack of a market for firewood. Coal is mined locally, and firewood has not been able to compete. Nevertheless, management could be improved.

Woodlots should be managed so that returns from forest products can be depended on as an integral part of the farm income. Woodlots can be made more useful through these practices (1) protection from grazing; (2) selective cutting to assure full growth of desirable kinds of trees; and (3) fire protection.

In selective cutting, the soils of a specific tract should be considered. Some of the most desirable timber trees grow successfully only on the deeper, better drained soils. Other timber species do well on shallow soils, and yet others, on the poorly and very poorly drained soils. Cutting should be planned, as nearly as possible, on an annual basis. Clear cutting at long intervals is not desirable.

Some den trees and good game-food trees should be left standing in farm woodlots to provide shelter and food for wildlife. Borders of shrubs around the woodlots will feed small game and serve as buffers between the trees and the cropland. On larger woodlots, cutback borders produce abundant sprout growth and reduce shading of crops. These borders provide good browse for deer. If the herd is normal, these borders will reduce damage to crops, because the deer will find much of their food in the border strips.

Many idle areas and some areas still cropped or pastured are not suitable for farming. They would be more useful as woodlots, but many of them reforest slowly. Planting of trees is therefore desirable. The kind of soil should be considered before planting. Select trees that are suitable to the soil, that will make good growth, and that will have good value when they are harvested. By observing plantings already made and using this report to determine the kinds of soils they are on, you can judge which trees will do well on the soils to be planted. If there is doubt about which species are suited to a soil, consult the Pennsylvania Department of Forests and Waters, the county extension agent, or a representative of the Soil Conservation Service.

Some of the idle land can be used for growing Christmas trees (fig. 5). Plantings of Christmas trees produce income sooner than plantings for other purposes, and shallow soils and low fertility are not barriers to production.

FIGURE 5.—Spruce and pine planted for Christmas trees and timber on Gilpin soils having slopes of 25 to 35 percent.

Soil Productivity

Table 1 gives estimated average acre yields of principal crops on the soils of the county under average management. The yields are based on the judgment of people familiar with the soils and agriculture of the county. They take into account the average yield of each crop for the county as a whole, in a representative year, and the distribution of this crop on the various soils.

The yields given in table 1 are a rough average under all levels of management prevailing in the 1950–54 period. Some farmers use little lime and fertilizer and no practices to conserve soil and water; some use good practices to build up fertility and to conserve soil and water; on wet soils different farmers use various levels of artificial drainage.

TABLE 1.—*Estimated average acre yields of principal crops on the soils of Clarion County, Pa.*

[Estimates based on 1950-54 levels of management. Soils that normally have more than 100 acres in cropland harvested are included in this table. This excludes only a small part of the total cropland. Absence of yield indicates crop ordinarily is not grown on the soil specified]

Soil	Corn	Wheat	Oats	Buckwheat	Hay clover timothy	Potatoes	Corn for silage	Pasture productivity	Forest productivity
	Bu.	*Bu.*	*Bu*	*Bu.*	*Tons*	*Bu.*	*Tons*		
Armagh silt loam, 0 to 2 percent slopes	20	12	20	20	1.0	-------	6.0	Poor	Poor.
Armagh silt loam, 2 to 8 percent slopes	25	12	25	20	1.0	-------	7.0	Poor	Poor.
Atkins silt loam, 0 to 5 percent slopes	25	12	25	-------	1.3	-------	9.0	Fair	Poor.
Brinkerton silt loam, 0 to 2 percent slopes	20	12	20	20	1.3	-------	8.0	Fair	Poor.
Brinkerton silt loam, 2 to 10 percent slopes	25	12	25	20	1.2	-------	9.0	Fair	Poor.
Cavode channery silt loam, 2 to 8 percent slopes	40	18	35	30	1.5	-------	9.5	Fair	Good.
Cavode channery silt loam, 8 to 15 percent slopes	40	18	35	30	1.5	-------	9.5	Fair	Good.
Cavode silt loam, 0 to 2 percent slopes	45	18	35	30	1.5	-------	11.0	Good	Good.
Cavode silt loam, 2 to 8 percent slopes	50	20	35	30	1.5	150	11.0	Good	Good.
Cavode silt loam, 8 to 15 percent slopes	45	20	35	30	1.3	140	10.5	Good	Good.
Cavode silt loam, 8 to 15 percent slopes, severely eroded	35	15	25	20	1.0	-------	7.5	Fair	Good.
Cavode silt loam, 15 to 25 percent slopes	35	18	25	20	1.2	-------	7.5	Fair	Good.
Clymer channery loam, 0 to 5 percent slopes	40	30	40	30	1.3	250	10.0	Fair	Good.
Clymer channery loam, 5 to 12 percent slopes	40	30	40	30	1.3	250	10.0	Fair	Good.
Clymer channery loam, 12 to 25 percent slopes	40	25	35	20	1.2	-------	9.0	Fair	Good.
Cookport channery loam, 2 to 8 percent slopes	30	18	35	-------	1.3	-------	10.0	Fair	Good.
Cookport channery silt loam, 0 to 2 percent slopes	35	20	35	25	1.3	-------	10.5	Fair	Good.
Cookport channery silt loam, 2 to 8 percent slopes	35	20	35	25	1.3	200	10.5	Fair	Good.
Cookport channery silt loam, 8 to 15 percent slopes	35	20	35	20	1.3	200	9.5	Fair	Good.
Cookport channery silt loam, 15 to 30 percent slopes	30	15	25	-------	1.2	-------	8.0	Fair	Good.
Cookport silt loam, 0 to 2 percent slopes	35	18	40	-------	1.3	-------	10.5	Fair	Good.
Cookport silt loam, 2 to 8 percent slopes	35	20	40	25	1.3	200	10.5	Fair	Good.
Cookport silt loam, 8 to 15 percent slopes	35	20	35	-------	1.3	-------	9.5	Fair	Good.
Dekalb channery loam, 0 to 5 percent slopes	40	20	35	25	1.2	225	7.5	Poor	Fair.
Dekalb channery loam, 5 to 12 percent slopes	40	20	35	25	1.2	225	7.5	Poor	Fair
Dekalb channery loam, 12 to 25 percent slopes	35	20	30	20	1.0	180	6.5	Poor	Fair.
Dekalb channery loam, 12 to 25 percent slopes, severely eroded	30	18	20	15	.8	-------	5.5	Poor	Poor.
Dekalb channery loam, 25 to 35 percent slopes	20	18	25	15	.9	-------	5.5	Poor	Fair.
Dekalb channery loam, 25 to 35 percent slopes, severely eroded	20	15	20	10	.8	-------	4.5	Poor	Poor
Dekalb channery sandy loam, 0 to 5 percent slopes	35	18	35	-------	1.0	-------	6.0	Poor	Fair.
Dekalb channery sandy loam, 5 to 12 percent slopes	35	18	35	-------	1.0	-------	6.0	Poor	Fair.
Dekalb channery sandy loam, 12 to 25 percent slopes	30	18	30	-------	.9	-------	5.5	Poor	Fair.
Dekalb channery sandy loam, 12 to 25 percent slopes, severely eroded	25	15	20	-------	.7	-------	5.0	Poor	Poor.
Dekalb channery sandy loam, 25 to 35 percent slopes	25	16	25	-------	.8	-------	5.0	Poor	Fair.
Dekalb loam, 0 to 5 percent slopes	40	20	35	-------	1.2	-------	7.5	Poor	Fair.
Dekalb loam, 5 to 12 percent slopes	40	20	35	-------	1.2	-------	7.5	Poor	Fair.
Ernest silt loam, 0 to 8 percent slopes	55	30	35	25	1.8	200	12.0	Good	Good.
Ernest silt loam, 0 to 8 percent slopes, severely eroded	45	20	30	15	1.5	-------	9.5	Fair	Good.
Ernest silt loam, 8 to 15 percent slopes	50	30	35	20	1.8	180	11.0	Good	Good.
Ernest silt loam, 8 to 15 percent slopes, severely eroded	45	20	30	10	1.4	-------	9.0	Fair	Good.
Ernest silt loam, 15 to 30 percent slopes	45	20	30	15	1.4	-------	9.0	Good	Good.
Gilpin channery loam, 5 to 12 percent slopes	40	25	35	-------	1.3	-------	8.0	Fair	Good.
Gilpin channery loam, 12 to 25 percent slopes	35	20	25	-------	1.2	-------	7.5	Fair	Fair.
Gilpin channery silt loam, 0 to 5 percent slopes	50	30	35	20	1.4	225	11.0	Fair	Good.
Gilpin channery silt loam, 5 to 12 percent slopes	50	30	35	20	1.4	200	11.0	Fair	Good.
Gilpin channery silt loam, 12 to 25 percent slopes	45	28	30	15	1.3	180	9.5	Fair	Fair.
Gilpin channery silt loam, 12 to 25 percent slopes, severely eroded	35	20	20	10	1.0	-------	6.5	Fair	Fair.
Gilpin shaly silt loam, 0 to 5 percent slopes	45	22	25	15	1.1	190	10.0	Fair	Fair.
Gilpin shaly silt loam, 5 to 12 percent slopes	45	20	25	15	1.1	170	10.0	Fair	Fair.
Gilpin shaly silt loam, 5 to 12 percent slopes, severely eroded	35	18	15	10	.9	-------	6.5	Poor	Fair.
Gilpin shaly silt loam, 12 to 25 percent slopes	40	18	20	15	1.0	160	7.5	Poor	Fair.
Gilpin shaly silt loam, 12 to 25 percent slopes, severely eroded	35	12	15	10	.8	-------	6.0	Poor	Poor.
Gilpin silt loam, 0 to 5 percent slopes	50	30	30	20	1.4	225	11.0	Fair	Good.
Gilpin silt loam, 5 to 12 percent slopes	50	30	30	20	1.4	200	11.0	Fair	Good.
Gilpin silt loam, 12 to 25 percent slopes	45	28	25	20	1.3	180	9.5	Poor	Fair.
Gilpin soils, 25 to 35 percent slopes	-------	-------	-------	-------	.9	-------	-------	Poor	Fair.
Gilpin soils, 25 to 35 percent slopes, severely eroded	-------	-------	-------	-------	.7	-------	-------	Poor	Poor.
Gilpin soils, 35 to 60 percent slopes	-------	-------	-------	-------	.9	-------	-------	Poor	Poor.
Gilpin soils, 35 to 60 percent slopes, severely eroded	-------	-------	-------	-------	.7	-------	-------	Poor	Poor.
Ginat silt loam, 0 to 5 percent slopes	35	15	20	-------	1.2	-------	8.0	Poor	Poor.
Gravelly terraces, 12 to 25 percent slopes	40	20	20	-------	1.3	-------	7.0	Fair	Fair.
Holston silt loam, 2 to 8 percent slopes	50	25	30	-------	1.4	-------	10.0	Fair	Good.
Lickdale silt loam, 0 to 2 percent slopes	10	-------	20	-------	1.2	-------	6.0	Poor	Poor.
Lickdale silt loam, 2 to 10 percent slopes	15	-------	20	-------	1.2	-------	6.0	Poor	Poor.

TABLE 1.—*Estimated average acre yields of principal crops on the soils of Clarion County, Pa.*—Continued

Soil	Corn	Wheat	Oats	Buckwheat	Hay clover timothy	Potatoes	Corn for silage	Pasture productivity	Forest productivity
	Bu.	*Bu*	*Bu.*	*Bu.*	*Tons*	*Bu.*	*Tons*		
Monongahela silt loam, 0 to 2 percent slopes	40	18	35	-------	1.4	-------	10.0	Fair----	Good.
Monongahela silt loam, 2 to 8 percent slopes	40	20	35	-------	1.4	-------	10.0	Fair----	Good.
Nolo silt loam, 0 to 2 percent slopes	20	-------	30	-------	1.0	-------	6.0	Poor----	Fair.
Nolo silt loam, 2 to 10 percent slopes	25	-------	30	-------	1.0	-------	6.0	Poor----	Fair.
Philo silt loam, 0 to 6 percent slopes	50	20	40	-------	1.7	-------	12.0	Good----	Good.
Pope silt loam, 0 to 5 percent slopes	50	30	40	-------	1.7	-------	12.0	Good----	Good.
Rayne silt loam, 0 to 5 percent slopes	55	35	40	-------	1.6	-------	12.0	Good----	Good.
Rayne silt loam, 5 to 12 percent slopes	55	35	40	-------	1.6	-------	10.0	Good----	Good.
Rayne silt loam, 12 to 25 percent slopes	45	30	30	-------	1.3	-------	9.0	Good----	Good.
Sciotoville silt loam, 0 to 2 percent slopes	45	18	40	-------	1.3	-------	11.0	Good----	Good.
Sciotoville silt loam, 2 to 8 percent slopes	50	20	40	-------	1.3	-------	11.0	Good----	Good.
Westmoreland silt loam, 5 to 12 percent slopes	55	30	40	-------	1.8	-------	12.0	Good----	Good.
Wharton silt loam, 0 to 2 percent slopes	50	25	40	-------	1.6	-------	10.5	Good----	Good.
Wharton silt loam, 2 to 8 percent slopes	50	25	40	-------	1.6	-------	10.5	Good----	Good.
Wharton silt loam, 8 to 15 percent slopes	45	25	35	-------	1.4	-------	9.5	Good----	Good.
Wharton silt loam, 15 to 25 percent slopes	40	20	30	-------	1.3	-------	8.0	Fair----	Good.
Wharton silt loam, concretionary variant, 0 to 5 percent slopes	55	27	40	-------	1.7	-------	12.0	Good----	Good.
Wharton silt loam, concretionary variant, 5 to 12 percent slopes	55	27	40	-------	1.7	-------	11.0	Good----	Good.
Wharton silt loam, concretionary variant, 12 to 30 percent slopes	45	25	30	-------	1.5	-------	9.0	Good----	Good.
Wheeling gravelly loam, 8 to 15 percent slopes	40	30	25	-------	1.3	-------	10.0	Good----	Good.
Wheeling silt loam, 0 to 2 percent slopes	50	30	35	-------	1.5	-------	10.0	Good----	Good.
Wheeling silt loam, 2 to 8 percent slopes	50	30	35	-------	1.5	-------	10.0	Good----	Good.

Yield data for pastures are not available, so only the terms, "good," "fair," and "poor," are used to indicate the relative suitability of the soils for pasture. The estimates of relative suitability are based on the growth rate of pasture and also on the quality of the forage produced.

If the soils of the county were not fertilized, limed, or manured, it is probable that practically all of them would eventually yield so little that farming them would not be worthwhile. Possible exceptions are some soils on the flood plains and the Westmoreland.

The response of the various soils to a high level of management is not fully known. Assuming that the best agronomic and conservation practices now known were applied, the yields obtained would be nearly the same for large groups of soils in the county; that is, groups that would contain more than one of the capability units already discussed.

If lime and fertilizer were applied liberally, soil structure and the supply of organic matter were kept at a high level, and practices for conserving soil and water were applied as needed, the deep and moderately deep, well drained and moderately well drained, medium-textured soils on nearly level to moderate slopes would respond in about the same way, and yields would be comparable.

Most of the shallow soils, the moderately deep soils on moderately steep slopes, and the more sandy soils, if given the same kinds of improved management as those discussed in the preceding paragraph, would show less response to management. Therefore, it would not be advisable to manage them so intensively. If supplemental irrigation were used, if special intensive feeding of plant nutrients accompanied irrigation, and all the other practices were applied, these shallow to moderately deep, moderately steep, and sandy soils might be brought to the level of the better soils. The difficulty of irrigating strongly sloping and shallow land makes it unlikely that this will become a general practice.

The poorly drained soils, as well as the somewhat poorly drained soils that have a dense, tight clay subsoil, can be improved somewhat by artificial drainage. But such drainage is normally too slow to allow bringing these soils up to the productivity level of the truly well drained soils. Ginat silt loam and several other soils limited by a high water table and too much surface water eventually can be brought to higher productivity by digging intercepting drains and installing tile.

Engineering Properties of the Soils

The properties of soils affect construction of roads, ponds and reservoirs, farm terraces, drainage systems, pipelines, and foundations for buildings. They influence grading of athletic fields and lawns. The soil properties most important are (1) permeability to water, (2) depth to consolidated materials, (3) texture, and (4) drainage.

PERMEABILITY.—The permeability of a soil is important in predicting how effective tile or open drains will be in lowering the water table. It also indicates whether or not small farm ponds will hold water. For large reservoirs, it is necessary to make special laboratory studies to determine how the soil materials at the exact site will perform, because, with large bodies of water, pressure increases greatly.

Table 2 gives depth ranges, volume weight, calculated pore space, and average percolation rate in surface soil and subsoil for silt loams of the Armagh,

Cavode, and Brinkerton series. Each value is an average of determinations made on six cores of the same soil. All the cores were collected in a small area, except in a few instances where one sample was lost or found to be defective. Percolation was measured under gravity head, with about 1 inch of water over the surface of the soil.

TABLE 2.—*Percolation pore space and volume weight data for three silt loams*

Soil type[1]	Depth	Volume weight[2]	Calculated total pore space	Percolation rate
	Inches		*Percent of volume*	*Inches per hour*
Brinkerton silt loam	0–6	1.21	54.3	0.98
	9–15	1.41	46.9	.008
Cavode silt loam	0–6	1.29	51.6	8.39
	15–21	1.55	41.4	.45
Armagh silt loam	0–6	1.29	51.3	9.03
	9–15	1.44	45.6	1.05
	[3] 9–15			.86

[1] Brinkerton and Cavode samples from a pastured field; the Armagh, from cultivated land across the road from the idle area where the profile described on page 21 was taken.
[2] Weight of water equals 1.00.
[3] Cores sampled horizontally to test permeability to lateral flow.

Attempts to measure percolation through core samples of Ernest silt loam were prevented by shale and sandstone fragments. Rough comparative tests by another method indicated that Ernest silt loam in a pastured field was much less permeable in the surface soil and upper subsoil than Cavode silt loam in a nearby hayfield. In the lower subsoil, this was reversed. The Cavode, at this depth, was much less permeable than the Ernest soil. Permeability of the Ernest soil was greater at this depth than near the surface.

DEPTH TO CONSOLIDATED MATERIALS.—The depth of a soil to hard bedrock affects the cost of grading or excavation for roads, pipelines, foundations, and farm ponds. In shallow soils, depth to bedrock is a factor to be considered before installing tile drainage or terraces. Depth to consolidated materials is mentioned for the various soils in the section describing the soils. The soils of the county can be grouped by depth to bedrock as follows:

MORE THAN 60 INCHES

MAPPING UNIT:	*Depth range in inches*
Ginat silt loam, 0 to 5 percent	60+
Gravelly terraces, 12 to 25 percent slopes	72–240
Gravelly terraces, 25 to 45 percent slopes	72–240
Sciotoville silt loam, 0 to 2 percent slopes	60–240
Sciotoville silt loam, 2 to 8 percent slopes	60–240
Sciotoville silt loam, 8 to 15 percent slopes	60–240
Shelocta silt loam, 2 to 8 percent slopes	60–180
Shelocta silt loam, 8 to 15 percent slopes	60–180
Wheeling gravelly loam, 0 to 8 percent slopes	60+
Wheeling gravelly loam, 8 to 15 percent slopes	60+
Wheeling silt loam, 0 to 2 percent slopes	60+
Wheeling silt loam, 2 to 8 percent slopes	60+
Wheeling silt loam, 8 to 15 percent slopes	60+
Wheeling silt loam, 15 to 25 percent slopes	60+

MORE THAN 48 INCHES

	Depth range in inches
Brinkerton silt loam, 0 to 2 percent slopes	48–240
Brinkerton silt loam, 2 to 10 percent slopes	48–240
Brinkerton stony silt loam, 0 to 8 percent slopes	48–240
Ernest silt loam, 0 to 8 percent slopes	48–120
Ernest silt loam, 8 to 15 percent slopes	48–120
Ernest silt loam, 15 to 30 percent slopes	48–120
Ernest stony silt loam, 2 to 15 percent slopes	48–120
Ernest stony silt loam, 15 to 30 percent slopes	48–120
Holston silt loam, 0 to 2 percent slopes	48–240
Holston silt loam, 2 to 8 percent slopes	48–240
Holston silt loam, 8 to 15 percent slopes	48–240
Pope silt loam, 0 to 5 percent slopes	48+
Tyler silt loam, 0 to 2 percent slopes	48+
Tyler silt loam, 2 to 10 percent slopes	48+

MORE THAN 36 INCHES

Atkins silt loam, 0 to 5 percent slopes	36+
Cavode channery silt loam, 2 to 8 percent slopes	36–48
Cavode silt loam, concretionary variant, 0 to 2 percent slopes	36–48
Cavode silt loam, concretionary variant, 2 to 8 percent slopes	36–48
Cavode silt loam, concretionary variant, 8 to 15 percent slopes	36–48
Cavode stony silt loam, 2 to 15 percent slopes	36–48
Ernest silt loam, 0 to 8 percent slopes, severely eroded	36–120+
Ernest silt loam, 8 to 15 percent slopes, severely eroded	36–120
Lickdale silt loam, 0 to 2 percent slopes	*40
Lickdale silt loam, 2 to 10 percent slopes	*40
Lickdale stony silt loam, 0 to 8 percent slopes	*40
Monongahela silt loam, 0 to 2 percent slopes	42+
Monongahela silt loam, 2 to 8 percent slopes	42+
Monongahela silt loam, 8 to 15 percent slopes	42+
Monongahela silt loam, 15 to 25 percent slopes	42+
Philo fine sandy loam, 0 to 6 percent slopes	40+
Philo silt loam, 0 to 6 percent slopes	40+
Pope fine sandy loam, 0 to 5 percent slopes	40+
Pope fine sand loam, 5 to 8 percent slopes	40+
Wharton silt loam, concretionary variant, 0 to 5 percent slopes	*36
Wharton silt loam, concretionary variant, 5 to 12 percent slopes	*36
Wharton silt loam, concretionary variant, 12 to 30 percent slopes, eroded	*36

MORE THAN 30 INCHES

Cavode channery silt loam, 8 to 15 percent slopes	30–36
Cavode silt loam, 0 to 2 percent slopes	32–44
Cavode silt loam, 2 to 8 percent slopes	32–44
Cavode silt loam, 8 to 15 percent slopes	30–36
Cavode silt loam, 15 to 25 percent slopes	**34
Cavode stony silt loam, 15 to 30 percent slopes	**36
Clymer channery loam, 0 to 5 percent slopes	32–50
Clymer channery loam, 5 to 12 percent slopes	32–50
Clymer channery loam, 12 to 25 percent slopes	30–40
Clymer loam, 0 to 5 percent slopes	32–50
Clymer loam, 5 to 12 percent slopes	32–50
Cookport channery loam, 2 to 8 percent slopes	32–40
Cookport channery loam, 8 to 15 percent slopes	32–40
Cookport channery silt loam, 0 to 2 percent slopes	30–40
Cookport channery silt loam, 2 to 8 percent slopes	30–40
Cookport silt loam, 0 to 2 percent slopes	30–40
Cookport silt loam, 2 to 8 percent slopes	30–40
Cookport stony silt loam, 0 to 15 percent slopes	30–40
Dekalb stony loam, 0 to 25 percent slopes	30–84
Leetonia stony sandy loam, 0 to 25 percent slopes	*30
Leetonia stony sandy loam, 25 to 60 percent slopes	*30
Nolo silt loam, 0 to 2 percent slopes	30+
Nolo silt loam, 2 to 10 percent slopes	30+
Nolo stony silt loam, 0 to 8 percent slopes	30+
Rayne silt loam, 0 to 5 percent slopes	32–40
Rayne silt loam, 5 to 12 percent slopes	32–40

	Depth range in inches
Rayne silt loam, 12 to 25 percent slopes	32–40
Wharton silt loam, 0 to 2 percent slopes	*32
Wharton silt loam, 2 to 8 percent slopes	*32
Wharton silt loam, 8 to 15 percent slopes	*32
Wharton silt loam, 15 to 25 percent slopes	**30
MORE THAN 24 INCHES	
Cavode silt loam, 2 to 8 percent slopes, severely eroded	24–36
Cavode silt loam, 8 to 15 percent slopes, severely eroded	24–40
Cavode silt loam, 15 to 25 percent slopes, severely eroded	**30
Cavode silt loam, 25 to 35 percent slopes, eroded	24–30
Cookport channery silt loam, 8 to 15 percent slopes	24–40
Cookport channery silt loam, 15 to 30 percent slopes	24–36
Cookport silt loam, 8 to 15 percent slopes	24–40
Cookport stony silt loam, 15 to 30 percent slopes	24–36
Dekalb channery sandy loam, 0 to 5 percent slopes	24+
Dekalb channery sandy loam, 5 to 12 percent slopes	24+
Dekalb channery sandy loam, 12 to 25 percent slopes	*24
Gilpin channery loam, 0 to 5 percent slopes	*24
Gilpin channery loam, 5 to 12 percent slopes	*24
MORE THAN 20 INCHES	
Armagh silt loam, 0 to 2 percent slopes	20–36
Armagh silt loam, 2 to 8 percent slopes	20–36
Armagh silt loam, 8 to 15 percent slopes	20–36
Armagh stony silt loam, 0 to 8 percent slopes	20–36
Dekalb channery loam, 0 to 5 percent slopes	*21
Dekalb channery loam, 5 to 12 percent slopes	*21
Dekalb loam, 0 to 5 percent slopes	*21
Dekalb loam, 5 to 12 percent slopes	*21
Dekalb loam, 12 to 25 percent slopes	*21
Dekalb stony loam, 25 to 35 percent slopes	20–60
Gilpin channery loam, 12 to 25 percent slopes	20–24
Gilpin channery silt loam, 0 to 5 percent slopes	20–30
Gilpin channery silt loam, 5 to 12 percent slopes	20–30
Gilpin channery silt loam, 12 to 25 percent slopes	20–24
Gilpin stony silt loam, 0 to 25 percent slopes	20–30
LESS THAN 20 INCHES	
Armagh silt loam, 2 to 8 percent slopes, severely eroded	15–30
Dekalb channery loam, 12 to 25 percent slopes	*18–36
Dekalb channery loam, 12 to 25 percent slopes, severely eroded	12–20
Dekalb channery loam, 25 to 35 percent slopes	16–36
Dekalb channery loam, 25 to 35 percent slopes, severely eroded	10–20
Dekalb channery loam, 35 to 60 percent slopes	12–20
Dekalb channery sandy loam, 12 to 25 percent slopes, severely eroded	16–20
Dekalb channery sandy loam, 25 to 35 percent slopes	15–60
Dekalb channery sandy loam, 35 to 60 percent slopes	12–48
Dekalb stony loam, 35 to 75 percent slopes	12–60
Gilpin channery loam, 12 to 25 percent slopes, severely eroded	*16
Gilpin channery silt loam, 12 to 25 percent slopes, severely eroded	16–20
Gilpin shaly silt loam, 0 to 5 percent slopes	10–30
Gilpin shaly silt loam, 5 to 12 percent slopes	10–20
Gilpin shaly silt loam, 5 to 12 percent slopes, severely eroded	8–16
Gilpin shaly silt loam, 12 to 25 percent slopes	*15
Gilpin shaly silt loam, 12 to 25 percent slopes, severely eroded	10–12
Gilpin silt loam, 0 to 5 percent slopes	18–32
Gilpin silt loam, 5 to 12 percent slopes	18–32
Gilpin silt loam, 12 to 25 percent slopes	18–32
Gilpin stony silt loam, 25 to 60 percent slopes	*12
Gilpin soils, 25 to 35 percent slopes	*15
Gilpin soils, 25 to 35 percent slopes, severely eroded	6–20
Gilpin soils, 35 to 60 percent slopes	*12
Gilpin soils, 35 to 60 percent slopes, severely eroded	6–12
Westmoreland silt loam, 0 to 5 percent slopes	18–36
Westmoreland silt loam, 5 to 12 percent slopes	18–36
Westmoreland silt loam, 12 to 25 percent slopes	*20
Westmoreland silt loam, 25 to 35 percent slopes	*15

*Approximate.
**Maximum depth; the range is toward shallower depths.

TEXTURE.—The texture of all soil horizons above bedrock, and the amount of coarse fragments in those horizons, is important in determining the suitability of a soil for engineering purposes. Texture of the various soils has been fairly closely defined in the section describing the soils. The texture terms used are standard for soil surveys, but they differ from the terms for texture used in engineering manuals. Following are definitions for standard soil survey textural terms used in this report:

Sandy loams.—Soil material that contains either 20 percent clay or less, and the percentage of silt plus twice the percentage of clay exceeds 30, and 52 percent or more sand; or less than 7 percent clay, less than 50 percent silt, and between 43 percent and 52 percent sand.

Loam.—Soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

Silt loam.—Soil material that contains 50 percent or more silt and 12 to 27 percent clay (or) 50 to 80 percent silt and less than 12 percent clay.

Silty clay loam.—Soil material that contains 27 to 40 percent clay and less than 20 percent sand.

Silty clay.—Soil material that contains 40 percent or more clay and 40 percent or more silt.

Clay.—Soil material that contains 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

In soil surveys, the texture is given for each layer, or horizon, in the profile. The name of the soil frequently contains a textural term. This term applies only to the texture of the surface soil.

In soil surveys, particle sizes are defined for the different textural separates as follows:

Texture:	Millimeters
Sand	2.0 to 0.05
Silt	0.05 to 0.002
Clay	Below 0.002

In the descriptions of the soils, coarse fragments are mentioned for the soils in which they occur. A few of the soils contain strata of gravel or high proportions of coarse fragments that may be suitable sources for material to be used in surfacing roads, making concrete, and the like.

DRAINAGE.—The natural drainage of the soils, given in the section describing the soils, affects their use in engineering. Anything less than good natural drainage indicates that ground water is seasonally high or that there is some plane in the subsurface layers along which seepage waters flow. Excavations in soils with impeded drainage tend to fill with water whenever the soils become wet. Natural drainage, with other factors such as acidity, is involved in the rate at which pipelines corrode. The stability of road subgrades is very dependent on drainage. Extra work is normally required to prepare satisfactory subgrades on poorly drained soils.

Soils of Clarion County

In this section each of the soils shown on the soil map is described. The soil descriptions are arranged in alphabetical order by series name. Each soil series is described, and a complete profile description of at least one member of the series is given. Each of the other soils of the series is compared with the soil for which a profile is described, and additional facts about each are given as needed. The capability unit is given for each soil. Further information on use and management of a soil may be found in the section on Use and Management of Soils.

The acreage, proportionate extent, and uses of the soils are given in table 3.

TABLE 3.—*Total acreage, proportionate extent, and use of soils in 1938*

Soil	County total	Proportionate extent	Cropland	Idle	Pasture	Woodland	Farmstead and Urban
	Acres	*Percent*	*Acre*	*Acres*	*Acres*	*Acres*	*Acres*
Armagh silt loam, 0 to 2 percent slopes	1,264	0.3	530	182	134	409	9
Armagh silt loam, 2 to 8 percent slopes	5,742	1.5	2,368	1,074	767	1,481	52
Armagh silt loam, 2 to 8 percent slopes, severely eroded	56	(1)	20	36			
Armagh silt loam, 8 to 15 percent slopes	175	(1)	61	58	28	28	
Armagh stony silt loam, 0 to 8 percent slopes	304	.1	4	5	24	271	
Atkins silt loam, 0 to 5 percent slopes	5,420	1.4	478	454	1,546	2,894	48
Brinkerton silt loam, 0 to 2 percent slopes	467	.1	136	43	148	140	
Brinkerton silt loam, 2 to 10 percent slopes	2,591	.7	895	393	573	713	17
Brinkerton stony silt loam, 0 to 8 percent slopes	466	.1	25	13	93	333	2
Cavode channery silt loam, 2 to 8 percent slopes	893	.2	492	132	96	171	2
Cavode channery silt loam, 8 to 15 percent slopes	2,015	.5	982	189	173	625	46
Cavode silt loam, 0 to 2 percent slopes	2,030	.5	1,181	374	126	325	24
Cavode silt loam, 2 to 8 percent slopes	36,011	9.4	18,246	7,880	2,654	6,135	1,096
Cavode silt loam, 2 to 8 percent slopes, severely eroded	194	.1	99	63	25	7	
Cavode silt loam, 8 to 15 percent slopes	14,942	4.0	6,853	2,260	1,112	4,485	232
Cavode silt loam, 8 to 15 percent slopes, severely eroded	896	.2	514	279	58	43	2
Cavode silt loam, 15 to 25 percent slopes	1,616	.4	770	217	201	420	8
Cavode silt loam, 15 to 25 percent slopes, severely eroded	477	.1	268	120	59	29	1
Cavode silt loam, 25 to 35 percent slopes, eroded	165	(1)	11	9	46	72	27
Cavode silt loam, concretionary variant, 0 to 2 percent slopes	45	(1)	40		4		1
Cavode silt loam, concretionary variant, 2 to 8 percent slopes	388	.1	259	14	69	40	6
Cavode silt loam, concretionary variant, 8 to 15 percent slopes	70	(1)	41	14	8	7	
Cavode stony silt loam, 2 to 15 percent slopes	5,019	1.3	48	101	228	4,642	
Cavode stony silt loam, 15 to 30 percent slopes	438	.1	5			433	
Clymer channery loam, 0 to 5 percent slopes	946	.2	551	100	43	241	11
Clymer channery loam, 5 to 12 percent slopes	1,791	.5	1,025	212	73	466	15
Clymer channery loam, 12 to 25 percent slopes	215	.1	103	28	7	77	
Clymer loam, 0 to 5 percent slopes	907	.2	392	154		360	1
Clymer loam, 5 to 12 percent slopes	321	.1	197	49	14	61	
Cookport channery loam, 2 to 8 percent slopes	1,152	.3	617	171	73	269	22
Cookport channery loam, 8 to 15 percent slopes	332	.1	91	60	31	150	
Cookport channery silt loam, 0 to 2 percent slopes	893	.2	439	151	20	283	
Cookport channery silt loam, 2 to 8 percent slopes	7,937	2.1	3,485	1,307	428	2,659	58
Cookport channery silt loam, 8 to 15 percent slopes	5,041	1.3	1,913	690	318	2,001	119
Cookport channery silt loam, 15 to 30 percent slopes	696	.2	155	69	70	402	
Cookport silt loam, 0 to 2 percent slopes	1,705	.4	836	276	45	522	26
Cookport silt loam, 2 to 8 percent slopes	15,655	4.1	6,840	2,140	860	5,739	76
Cookport silt loam, 8 to 15 percent slopes	3,486	1.0	686	750	252	1,789	9
Cookport stony silt loam, 0 to 15 percent slopes	16,054	4.2	97	192	212	15,543	10
Cookport stony silt loam, 15 to 30 percent slopes	456	.1	4	3	9	437	3
Dekalb channery loam, 0 to 5 percent slopes	890	.2	533	96	20	218	23
Dekalb channery loam, 5 to 12 percent slopes	5,382	1.4	2,379	782	260	1,887	74
Dekalb channery loam, 12 to 25 percent slopes	5,125	1.3	1,697	826	430	2,099	73
Dekalb channery loam, 12 to 25 percent slopes, severely eroded	355	.1	195	104	39	16	1
Dekalb channery loam, 25 to 35 percent slopes	1,381	.4	377	151	132	713	8
Dekalb channery loam, 25 to 35 percent slopes, severely eroded	427	.1	179	129	71	44	4
Dekalb channery loam, 35 to 60 percent slopes	531	.1	56	120	123	232	
Dekalb channery sandy loam, 0 to 5 percent slopes	1,426	.4	967	119	66	249	25
Dekalb channery sandy loam, 5 to 12 percent slopes	4,085	1.1	1,884	590	231	1,337	43
Dekalb channery sandy loam, 12 to 25 percent slopes	2,184	.6	634	326	143	1,077	4
Dekalb channery sandy loam, 12 to 25 percent slopes, severely eroded	248	.1	106	81	46	15	
Dekalb channery sandy loam, 25 to 35 percent slopes	424	.1	143	75	23	183	
Dekalb channery sandy loam, 35 to 60 percent slopes	105	(1)	6	6	11	82	

TABLE 3.—*Total acreage, proportionate extent, and use of soils in 1938*—Continued

Soil	County total	Proportionate extent	Cropland	Idle	Pasture	Woodland	Farmstead and Urban
	Acres	*Percent*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Dekalb loam, 0 to 5 percent slopes	411	.1	239	84	5	83	
Dekalb loam, 5 to 12 percent slopes	472	.1	244	63	28	137	
Dekalb loam, 12 to 25 percent slopes	170	(1)	44	7	32	87	
Dekalb stony loam, 0 to 25 percent slopes	19,034	5.1	233	314	235	18,182	70
Dekalb stony loam, 25 to 35 percent slopes	10,604	2.9	49	87	38	10,418	12
Dekalb stony loam, 35 to 75 percent slopes	17,846	4.7	136	33	31	17,622	24
Ernest silt loam, 0 to 8 percent slopes	19,665	5.1	9,771	2,204	3,390	4,030	270
Ernest silt loam, 0 to 8 percent slopes, severely eroded	247	.1	117	16	104	10	
Ernest silt loam, 8 to 15 percent slopes	18,690	5.0	8,283	2,643	2,697	4,797	270
Ernest silt loam, 8 to 15 percent slopes, severely eroded	360	.1	135	149	67	9	
Ernest silt loam, 15 to 30 percent slopes	984	.3	314	207	120	325	18
Ernest stony silt loam, 2 to 15 percent slopes	4,767	1.2	35	81	186	4,398	67
Ernest stony silt loam, 15 to 30 percent slopes	283	.1		18	5	260	
Gilpin channery loam, 0 to 5 percent slopes	102	(1)	43	13	10	29	7
Gilpin channery loam, 5 to 12 percent slopes	919	.2	482	94	34	297	12
Gilpin channery loam, 12 to 25 percent slopes	2,439	.6	876	282	117	1,078	86
Gilpin channery loam, 12 to 25 percent slopes, severely eroded	169	(1)	82	47	35	5	
Gilpin channery silt loam, 0 to 5 percent slopes	469	.1	299	57	32	76	5
Gilpin channery silt loam, 5 to 12 percent slopes	5,105	1.3	2,638	651	264	1,460	92
Gilpin channery silt loam, 12 to 25 percent slopes	11,565	3.0	4,668	1,424	1,087	4,292	94
Gilpin channery silt loam, 12 to 25 percent slopes, severely eroded	815	.2	458	211	100	46	
Gilpin shaly silt loam, 0 to 5 percent slopes	859	.2	574	108	58	101	18
Gilpin shaly silt loam, 5 to 12 percent slopes	6,649	1.7	3,826	845	456	1,424	98
Gilpin shaly silt loam, 5 to 12 percent slopes, severely eroded	253	.1	117	97	22	17	
Gilpin shaly silt loam, 12 to 25 percent slopes	15,389	4.0	7,665	2,172	1,404	4,009	139
Gilpin shaly silt loam, 12 to 25 percent slopes, severely eroded	1,653	.4	820	494	168	167	4
Gilpin silt loam, 0 to 5 percent slopes	667	.2	449	31	66	113	8
Gilpin silt loam, 5 to 12 percent slopes	4,758	1.2	2,702	602	292	924	238
Gilpin silt loam, 12 to 25 percent slopes	10,503	2.7	5,757	1,378	981	2,099	288
Gilpin stony silt loam, 0 to 25 percent slopes	2,578	.9	38	84	64	2,390	2
Gilpin stony silt loam, 25 to 60 percent slopes	2,601	.7	9	37	68	2,466	21
Gilpin soils, 25 to 35 percent slopes	10,593	2.9	2,398	1,532	1,181	5,386	96
Gilpin soils, 25 to 35 percent slopes, severely eroded	3,869	1.0	1,791	1,032	606	416	24
Gilpin soils, 35 to 60 percent slopes	886	.2	286	295	159	146	
Gilpin soils, 35 to 60 percent slopes, severely eroded	2,886	.9	166	272	235	2,196	17
Ginat silt loam, 0 to 5 percent slopes	331	.1	200	6	97	28	
Gravelly terraces, 12 to 25 percent slopes	81	(1)	41	6	22	11	1
Gravelly terraces, 25 to 45 percent slopes	94	(1)	30	28	11	22	3
Holston silt loam, 0 to 2 percent slopes	213	.1	45	19	6	41	102
Holston silt loam, 2 to 8 percent slopes	511	.1	222	57	25	46	161
Holston silt loam, 8 to 15 percent slopes	434	.1	88	77	11	149	109
Leetonia stony sandy loam, 0 to 25 percent slopes	2,412	.6	12	18	11	2,369	2
Leetonia stony sandy loam, 25 to 60 percent slopes	1,576	.4		4	1	1,571	
Lickdale silt loam, 0 to 2 percent slopes	3,870	1.0	556	514	792	1,999	9
Lickdale silt loam, 2 to 10 percent slopes	1,169	.3	167	194	267	533	8
Lickdale stony silt loam, 0 to 8 percent slopes	163	(1)	3	1	30	129	
Monongahela silt loam, 0 to 2 percent slopes	394	.1	218	51	30	87	8
Monongahela silt loam, 2 to 8 percent slopes	1,390	.4	598	228	178	287	99
Monongahela silt loam, 8 to 15 percent slopes	95	(1)	21	38	2	23	11
Monongahela silt loam, 15 to 25 percent slopes	44	(1)	11	29	2	2	
Nolo silt loam, 0 to 2 percent slopes	2,157	.6	258	679	59	1,161	
Nolo silt loam, 2 to 10 percent slopes	1,838	.5	183	562	69	1,019	5
Nolo stony silt loam, 0 to 8 percent slopes	386	.1		134		252	
Philo fine sandy loam, 0 to 6 percent slopes	2,284	.6	30	41	31	2,174	8
Philo silt loam, 0 to 6 percent slopes	3,526	1.0	422	380	911	1,735	78
Pope fine sandy loam, 0 to 5 percent slopes	486	.1	51	38	52	293	52
Pope fine sandy loam, 5 to 8 percent slopes	162	(1)	8	8	1	22	123
Pope silt loam, 0 to 5 percent slopes	560	.1	180	54	128	148	50
Rayne silt loam, 0 to 5 percent slopes	1,215	.3	879	41	54	95	146
Rayne silt loam, 5 to 12 percent slopes	1,245	.3	880	141	23	162	39
Rayne silt loam, 12 to 25 percent slopes	289	.1	121	66	10	88	4
Sciotoville silt loam, 0 to 2 percent slopes	1,407	.4	858	89	69	364	27
Sciotoville silt loam, 2 to 8 percent slopes	1,204	.3	624	152	123	266	39
Sciotoville silt loam, 8 to 15 percent slopes	231	.1	68	61	39	56	7
Shelocta silt loam, 2 to 8 percent slopes	112	(1)	75	1	18	18	
Shelocta silt loam, 8 to 15 percent slopes	167	(1)	41	29	67	20	10
Tyler silt loam, 0 to 2 percent slopes	276	.1	51	122	32	71	
Tyler silt loam, 2 to 10 percent slopes	183	(1)	84	44	51	4	

TABLE 3.—*Total acreage, proportionate extent, and use of soils in 1938*—Continued

Soil	County total	Proportionate extent	Cropland	Idle	Pasture	Woodland	Farmstead and Urban
	Acres	*Percent*	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Westmoreland silt loam, 0 to 5 percent slopes	50	(1)	41	2	6	1	
Westmoreland silt loam, 5 to 12 percent slopes	163	(1)	141	11	3	8	
Westmoreland silt loam, 12 to 25 percent slopes	77	(1)	47	13	9	8	
Westmoreland silt loam, 25 to 35 percent slopes, eroded	38	(1)	13	6	13	6	
Wharton silt loam, 0 to 2 percent slopes	144	(1)	119	7		10	8
Wharton silt loam, 2 to 8 percent slopes	1,322	.3	805	157	89	253	18
Wharton silt loam, 8 to 15 percent slopes	1,572	.4	874	217	160	313	8
Wharton silt loam, 15 to 25 percent slopes	410	.1	237	49	45	77	2
Wharton silt loam, concretionary variant, 0 to 5 percent slopes	323	.1	248	5	41	27	2
Wharton silt loam, concretionary variant, 5 to 12 percent slopes	1,126	.3	711	130	130	136	19
Wharton silt loam, concretionary variant, 12 to 30 percent slopes, eroded	305	.1	173	10	61	59	2
Wheeling gravelly loam, 0 to 8 percent slopes	20	(1)	5	14		1	
Wheeling gravelly loam, 8 to 15 percent slopes	543	.1	253	122	74	68	26
Wheeling silt loam, 0 to 2 percent slopes	558	.1	461	36	18	32	11
Wheeling silt loam, 2 to 8 percent slopes	852	.2	549	95	26	118	64
Wheeling silt loam, 8 to 15 percent slopes	189	.1	79	36	17	36	21
Wheeling silt loam, 15 to 25 percent slopes	73	(1)	23	11	8	31	
Made land, mine dumps and strip mine spoil	3,996	1.0					
Total	383,360	100.0					

[1] Less than 0.1 percent.

Armagh Series

In the Armagh series are upland soils that developed on clay shale. They are associated with the better drained soils of the Wharton and Cavode series. They occur on gentle to moderate slopes, mostly in the northwestern part of the county. In other parts of the county there are smaller areas on gentle slopes that are marked by outcrops of clay shale.

Wooded areas have mostly oaks and maples, but hickory and ash are more numerous than on better drained soils.

The total area of the Armagh soils is about 11 square miles. Two-fifths of this area is cropped, and almost one-fifth is idle.

Armagh soils are poorly drained because they have a tight silty clay subsoil. The surface soil stays wet much of the season.

Armagh silt loam, 0 to 2 percent slopes (Aa).—This soil has varying amounts of shale and weathered sandstone throughout the profile because it developed from parent rocks in which there were alternate layers of shale and sandstone.

Profile in a cultivated area:

0 to 7 inches, dark grayish-brown silt loam; fine granular or soft crumbly structure when partly dry.

7 to 14 inches, yellowish-brown silty clay loam with weak mottlings of pale brown and gray; finer textured than surface layer; moderately strong subangular blocky structure; blocky aggregates mostly coated with gray; moderately plastic when wet, hard when dry; bottom of layer ranges in depth from 12 to 20 inches; gradual transition to layer below.

14 to 20 inches, light-gray to medium-gray compact silty clay loam mottled with strong brown; some small reddish-brown and black concretions; in many places contains small bits of coal or dark-colored shale from weathered coal veins; lower boundary ranges from 20 to 36 inches in depth.

20 to 30 inches, blocky structure is less distinct than in the horizon above, and structure is mainly coarse platy, inherited from parent clay shale; depth of lower boundary of this horizon ranges from 30 to 40 inches.

30 inches +, parent material of slightly weathered bedrock, commonly acid, thin-bedded clay shale; in places sandstone or soil overlies silty shale because the entire vein of clay shale has been used in developing the soil.

In wooded areas the surface soil to a depth of 3 inches is very dark gray. Underneath that it is paler gray.

Management needs: Very slow movement of water through the subsoil and underlying shale make this soil difficult to drain. Drainage by tile is too slow to be effective. Open drainageways remove surface water and some from the surface layer but have little effect on the subsoil. Because the entire soil is fairly strongly acid, expensive management practices are required to maintain soil fertility.

Capability: Limited to Class III because of natural wetness. The season for cultivating soil is short because of poor drainage. Only short-season crops and perennials resistant to winterkilling are suited. Winter wheat is very badly damaged by winterkilling in most years. In some winters, however, wheat is protected by snow and yields well. Capability unit IIIw–1.

Armagh silt loam, 2 to 8 percent slopes (Ab).—This soil covers almost four-fifths of the acreage occupied by Armagh soils. It is similar to Armagh silt loam, 0 to 2 percent slopes, except that it occupies slopes sufficiently strong for rapid removal of surface water. This makes the soil less wet, more susceptible to ero-

sion, and easier to drain than the less sloping soil. This soil is less uniform in depth and texture than Armagh silt loam, 0 to 2 percent slopes, but the range in other characteristics is the same. Erosion is moderate on more than two-thirds of the area.

The very slow movement of water downward through the soil has produced fairly frequent and heavy surface runoff. Surface drainage is fairly good.

Conservation practices: Surface drains and diversions are effective in cutting off internal flow of water over the top of the dense blocky subsoil. In this way moderate improvement of drainage can be obtained, but the soil will still have limited suitability for cropping.

Capability: Class III because of a combination of wetness and risk of erosion. Crop suitability is limited. A few pastures have been drained and fertilized and produce high-quality grazing. Much of the acreage is idle or covered with grasses and weeds of little value. Capability unit IIIe–6.

Armagh silt loam, 2 to 8 percent slopes, severely eroded (Ac).—The plow layer now is a mixture of the remaining surface soil with a large amount of silty clay subsoil. It is low in organic matter and is moderately plastic when wet. When dry, it is hard and cloddy. The subsoil is similar to that in other Armagh soils except that it is thinner. The total depth to slightly weathered bedrock ranges from 15 to 30 inches. Nearly all of the original surface soil has been lost through erosion; gullies have cut through the thin plow layer in nearly all areas.

Capability: Class III because of combination of poor drainage and risk of erosion. Preparation of a good seedbed is difficult because of gullying and the poor structure of the plow layer. Winterkilling of grains and legumes is general. Capability unit IIIe–6.

Armagh silt loam, 8 to 15 percent slopes (Ad).—Only a small acreage of this soil is shown on the soil map. Other areas, too small to map, are scattered through the Cavode and Gilpin soils. These appear as seep spots and show poor drainage and the typical Armagh profile. This soil is usually not so deep as the more gently sloping Armagh soils, but it has as much variation in characteristics. Erosion is generally moderate except in wooded areas.

Capability: Class VI because of wetness and risk of erosion. Most suitable and most intensive practical use is for long-term hay or pasture. Grasses and legumes that can survive under very wet conditions should be used. Capability unit VIe–3.

Armagh stony silt loam, 0 to 8 percent slopes (Ae).—Many sandstone boulders are scattered on and through this soil. These boulders are residue from a stratum of hard sandstone that laid close to the clay shale that weathered to form parent material of the Armagh soils.

The profile of this soil is similar to that of Armagh silt loam, 0 to 2 percent slopes, except for some grittiness near the weathering blocks of sandstone. Most of the silt loam has been plowed and mixed to a depth of 7 or 8 inches, but the stony silt loam near the boulders has not been disturbed. The surface is covered with leaf mold, and the upper 2 or 3 inches of the silt loam soil is colored very dark gray with organic matter.

Capability: Too stony for cultivation. Capability unit VIw–1.

Atkins Series

The Atkins series is made up of poorly drained flood-plain soils along streams. Along the larger streams Atkins soils are associated with the well-drained Pope and the moderately well drained Philo soils. Along many of the smaller streams the entire flood plain is Atkins soils. In upstream areas where flood plains are not well defined and flooding is infrequent, the Atkins grade into the Lickdale soils. Some areas of Atkins soils are flooded nearly every year. Along some small streams, overflow normally occurs several times a year. Along some of the major streams, floods are not so frequent.

Atkins silt loam, 0 to 5 percent slopes (Af).—This is the only soil of the Atkins series mapped in Clarion County. Its range in texture results from differences in texture of the upland soils from which the materials were washed, as well as differences in rate of stream flow when the materials were laid down. The dominant texture is a silt loam, but spots of loam, sandy loam, gravelly loam, and silty clay loam are included. Most of the area of this soil is nearly level, or on slopes of less than 2 percent. Locally there are spots of recent alluvium that have slopes of slightly more than 5 percent.

This soil is moderately permeable except in the small spots that have a fine texture. Drainage varies widely in short distances but is predominantly poor because the water table stays close to the surface except when the streams go dry. Some small better drained areas are included with this soil, but they do not significantly affect use of the soil and are not large enough to map separately.

Wooded areas, which cover more than half of the acreage, have a mixed stand of hardwood trees. Hickory, ash, elm, and red maple are most common. Also there are scattered butternut (white walnut) and some sycamore and crabapple trees. The understory is alder, spicebush, elderberry, and ironwood. Open areas have blackberries, raspberries, and many weeds and herbs. Skunkcabbage is a common plant.

As it is forming in recent alluvium, this soil is variable. Following is a profile typical of Atkins silt loam in the western part of the county:

0 to 4 inches, very dark grayish-brown structureless silt loam.
4 to 13 inches, strongly mottled dark-gray and dark reddish-brown silt loam; very weak subangular blocky structure.
13 inches +, stratified silt loam, loam, and sandy loam.

All layers of this soil are nonplastic and are moderately acid; pH values range from 4.5 to 5.6. Cultivated areas have been limed and therefore are less acid than normal. Where the flood plains receive runoff from strip-mine areas or drainage water from mines, the soil is strongly acid.

Damage through erosion normally is offset by deposits, but there are a few eroded spots.

Capability: Class VI because of poor drainage and risk of flooding. Frequent flooding and a high water table limit usefulness of this soil. Where drainage can be installed to lower the water table, and where flooding is not severe, more intensive use of the soil is possible. Without improvements for drainage and flood control, pasture grasses and legumes that tolerate wetness for long periods are best suited. For satisfactory results, pasture must be protected from grazing during wet periods. The pastures are generally of low quality, but they provide some feed in midsummer when drier soils are not producing much. Capability unit VIw–2.

Brinkerton Series

The Brinkerton series consists of poorly drained soils on gentle to moderate lower slopes. These soils occur throughout the county in bands and isolated spots below uplands on which there are Gilpin, Dekalb, or Cavode soils. Brinkerton soils are associated with the moderately well drained to somewhat poorly drained soils of the Ernest series and with the very poorly drained soils of the Lickdale series. They differ from the somewhat similar Armagh series in being deep to bedrock and in not having developed from underlying rock. Rather they have developed on material that has slid down or has washed from the higher slopes. This movement of material took place so long ago that the soils now have a well-expressed profile.

The native vegetation includes oaks, red maple, some hickory, ash, alder, dogwood, thornapple, spicebush, and ironwood.

Because these soils are on lower slopes, they receive runoff and seep from higher areas. The wetness caused this way can be remedied by digging intercepting drains that will carry water away before it reaches these soils.

The total area is about 5½ square miles. About one-third is in woodland, and almost one-third is cropped. The rest is pasture and brushy idle land.

Brinkerton silt loam, 0 to 2 percent slopes (Ba).—This soil has a profile essentially like that of Brinkerton silt loam, 2 to 10 percent slopes. Surface drainage is poor and difficult to improve. Erosion is normally overbalanced by deposition of material washed from steeper slopes.

Capability: Class III because of poor drainage. Capability unit IIIw–1.

Brinkerton silt loam, 2 to 10 percent slopes (Bb).—This soil frequently has some small- to medium-sized pieces of sandstone on the surface and throughout the profile. Slopes range from 2 to 10 percent, but most of the area has slopes between 2 and 6 percent. The surface is broken by intermittent drains and receives both runoff and subsurface seep from higher land. Natural drainage is poor. The soil is strongly acid except where limed.

Profile in a cultivated area:

0 to 8 inches, dark grayish-brown silt loam; weak fine to medium granular structure; friable when not too wet.
8 to 20 inches, mottled yellow and gray silty clay loam that becomes heavier and more compact with depth; breaks into moderately stable blocks; in lower part blocks arranged one on top of another; entire layer hard and cracked when dry, but plastic when wet.
20 to 24 inches, silty clay loam; blocks are larger than in layer above and arranged in compact pattern; surfaces of blocks coated with gray and mottled gray and yellowish brown.
24 to 48 inches +, strong-brown silt loam, streaked with gray clay along a few large cracks; some sandstone and shale fragments; frequently contains small pieces of coal; may reach 20 feet or more, but usual depth is 5 to 10 feet; underlain by flat-bedded sandstone and shale bedrock.

In wooded areas or areas that have been a long time under sod, the top 2 or 3 inches of the surface soil is very dark gray and the part underlying is a lighter brownish gray and shows a slightly platy structure. Erosion is moderate in most areas but none or slight in wooded areas.

Capability: Class III because of combination of poor drainage and moderate slope. Suitable for many crops if drainage is improved. Diversion of water reaching this soil from higher areas is the first need for improvement. Along with this is drainage of the seep spots that remain wet for long periods. In seasons of heavy rainfall, even if it has been drained, the soil will still be too wet for some crops because of its tight subsoil. Liming and heavy use of fertilizer are necessary for worthwhile production on improved areas. Pasture areas are normally brushy because of difficulty in mowing where drainage has not been improved. Capability unit IIIe-6.

Brinkerton stony silt loam, 0 to 8 percent slopes (Bc).—This soil resembles the Brinkerton silt loams except for sandstone boulders widely scattered on the surface and throughout the soil. The boulders range from 8 or 10 inches to 3 or 4 feet in diameter. There are a few small areas more stony than the rest of the soil.

Capability: Class VI because of the combination of stoniness and poor drainage. Best suited to woodland or pasture because of poor drainage and stoniness that interferes with operation of farm machinery. Careful management and choice of grasses that tolerate a wet soil are necessary to obtain productive pasture. Capability unit VIw–1.

Cavode Series

The Cavode series consists of somewhat poorly drained upland soils that have developed on weathered clay shale. These soils occur extensively in the northwestern part of the country on rolling hilltops. Smaller areas are scattered in all parts of the county on outcrops of clay shale. These soils are associated with the better drained Wharton and the poorly drained Armagh soils.

The native vegetation is mixed hardwoods. White and red oaks, red maple, chestnut, and black cherry

are the most common on these soils. Tulip-poplar, hickory, scarlet oak, basswood, sassafras, shadbush, and dogwood are minor hardwoods. In a few places white pines and hemlocks occur in the forests on the Cavode soils.

The total area is more than 102 square miles. About 45 percent is used for crops. Almost 18 percent is idle, and about 7 percent is in permanent pasture. More than 26 percent is wooded.

The tight silty clay subsoil of the Cavode soils and the underlying clay shale restrict downward movement of water. Runoff is greater than from some of the more permeable soils on the same sort of slopes. The surface soil is easily dispersed and so fine textured that it is easily eroded. This makes the Cavode soils some of the most erodible soils in the county. Except for the concretionary variant, the soils are acid throughout. They have a moderately high capacity to store and hold nutrients so that the fertility can be built up by heavy applications of lime and fertilizer.

The concretionary variant included with the Cavode series has some limestone in the parent material. Although it is predominantly acid, some lime is usually present at depths of 4 to 5 feet.

The somewhat poor drainage of these soils restricts the growth of some plants but is generally not bad enough to require complete artificial drainage for any crops except those very sensitive to moisture.

Cavode channery silt loam, 2 to 8 percent slopes (Ca).—This soil contains many fragments of sandstone up to 6 or 8 inches in length and 1 or 2 inches thick. These fragments make up about 20 percent of the soil but vary in amount and size from place to place. Erosion is mostly moderate.

Profile in a cultivated area:

0 to 8 inches, dark grayish-brown silt loam of weak fine granular structure; crumbly or friable but packs very tightly if worked when wet; layer is light grayish brown when dry.

8 to 11 inches, yellowish-brown channery heavy silt loam; moderate medium subangular blocky structure; firm when moist and hard when dry; in the best drained areas this layer extends to a depth of 20 inches; in more poorly drained and some eroded areas this layer does not exist.

11 to 14 inches, very pale brown channery silty clay loam, mottled with strong brown and a little gray; moderate medium subangular blocky structure, which becomes more blocky with depth; firm when moist and slightly plastic when wet.

14 to 40 inches, strongly mottled gray, yellow, and brown silty clay loam; contains some red streaks; firm when moist and plastic when wet; material shrinks as it dries; cracks extend to bottom of horizon in extremely dry season; gray color mostly concentrated on surface of well-developed angular blocks; blocks, arranged one on top of another in irregular prisms, are 1 inch across near top and 2 or 3 inches across near bottom.

40 inches +, light-gray, somewhat mottled with darker gray or occasionally brown, slightly weathered clay shale; platy structure; contains small fragments of coal or carbonaceous shale in some places; total depth of profile varies, and maximum depth of solum above shale is about 48 inches.

Management needs: The natural internal drainage is slow and difficult to improve. Surface drainage is good. Careful control of surface water by diversions, cutting off seep-water by spot tile drainage, and selection of crops that withstand extremely wet periods help in use of this soil without complete drainage.

Capability: Class III because of erosion hazard and drainage problem. Can be used for general crops of the area, but failures with alfalfa, potatoes, and winter grains are frequent. Capability unit IIIe–5.

Cavode channery silt loam, 8 to 15 percent slopes (Cb).—This moderately sloping soil is similar to the Cavode channery silt loam, 2 to 8 percent slopes, except for having stronger slopes and slightly less depth to parent material. Bedrock is at a depth of 36 inches in most places. There has been some concentration of sandstone fragments on the surface or in the plow layer because erosion has removed the finer material. Erosion is mostly moderate in cleared areas, and about 15 percent of cleared soil contains gullies. The erosion hazard is greater on this soil than on Cavode channery silt loam, 2 to 8 percent slopes.

Capability: Class III because of erosion hazard and slow internal drainage. Capability unit IIIe–5.

Cavode silt loam, 0 to 2 percent slopes (Cc).—This soil has a profile very similar to that of Cavode silt loam, 2 to 8 percent slopes. It differs from that soil in having less erosion in cultivated areas and somewhat less desirable drainage. Surface water tends to accumulate in surface depressions and to drain away more slowly. On the average, subsoil mottling is nearer the surface than in Cavode silt loam, 2 to 8 percent slopes, but the range in depth to mottling is the same.

Generally sandstone and shale fragments are scarce, but a few small channery areas are included with this soil.

Capability: Class III. Drainage and water disposal problems exceed erosion hazard in limiting the use of this soil. Capability unit IIIw–2.

Cavode silt loam, 2 to 8 percent slopes (Ce).—This soil occurs on gentle smooth slopes, generally of considerable extent. Internal drainage is somewhat poor, and natural fertility is not high, but the capacity for holding nutrients is high. The soil is acid throughout.

Profile in a cleared area:

0 to 8 inches, dark grayish-brown (moist) to light grayish-brown (dry) smooth, crumbly silt loam of weak fine granular structure; friable when moist but structure easily destroyed if soil is worked when wet; contains a few coarse particles.

8 to 11 inches, yellowish-brown, fine-textured silt loam; moderately well developed, medium-sized, irregular blocky structure; contains a few coarse fragments; firm when moist; slightly less acid than horizon above except where surface has been recently limed; layer absent in most poorly drained areas but up to 12 inches thick in areas where drainage approaches that of the Wharton soils.

11 to 14 inches, mottled very pale brown and strong-brown silty clay loam; moderate medium blocky structure, increasingly distinct with depth; firm when moist and hard when dry; wavy but clear boundary with layer below.

14 to 44 inches, strongly mottled gray, brown, and yellowish-brown silty clay loam; frequently streaked and mottled with red and yellowish red; firm and dense when moist, moderately plastic when wet; horizon made up of distinct strongly developed blocks arranged one on top of

another in rough prisms; faces of blocks coated with gray clay; coating as much as 1/10 inch thick along the most prominent vertical cracks; size of blocks increases with depth because some vertical cracks do not penetrate whole depth of horizon; on drying, blocks shrink, become very hard; if blocks are dried and rewetted they slake to fine particles and run together; blocks very closely packed, and soil is slowly permeable at field moisture conditions; layer contains a few fragments of sandstone or hard shale; total depth of horizon varies; grades into next layer at depths between 32 and 50 inches.

44 inches +, mottled gray and dark-gray clay; blocky structure; breaks into horizontal plates showing beddings of clay shale; very firm in place; in places contains small bits of coal and carbonaceous shale; more strongly acid than layers above.

In woodland areas the surface is covered with hardwood leaf litter in varying stages of rotting. Below the leaf litter is a thin layer of well-rotted organic material, mixed with some mineral soil, that shows evidence of abundant worm and insect life. Under this, the first 4 inches of mixed organic matter and mineral soil are stained very dark gray and are very friable. From 4 to 8 inches the soil is yellowish-brown smooth silt loam with weak platy structure. These medium-sized platy particles easily crumble to medium granules. Erosion is generally moderate, but there has been slight or no erosion on about 5,200 acres, nearly all of which is wooded.

Conservation practices: Needs careful control of surface water to reduce seasonal waterlogging and to prevent erosion. The diversion of water from slopes, spot drainage of areas where seep water concentrates, and choice of crops tolerant of occasional wet periods are effective. Intertilled crops should be planted in rows on a uniform grade sufficient to prevent surface ponding but not strong enough to encourage erosion.

Capability: Class III because of combined erosion hazard and drainage problem. Suitable for most general crops. Productivity can be greatly increased by heavy liming and fertilizing. Alfalfa usually does not last long but sometimes yields well for 1 or 2 years. Winter grain produces well in some seasons and with a good snow cover, but freezeouts are frequent. Potatoes are sometimes damaged when the soil becomes waterlogged. Cabability unit IIIe–5.

Cavode silt loam, 2 to 8 percent slopes, severely eroded (Cf).—This soil is similar to the Cavode silt loam, 2 to 8 percent slopes, except that it is shallower and has lost the original surface soil. The light grayish-brown heavy silt loam plow layer, 5 or 6 inches deep, consists of remnants of the original surface soil that have been mixed with the upper subsoil. This layer is firm when moist and hard and lumpy when dry. In many places mottling starts immediately below this layer. Nearly all of the original silt loam surface soil has been lost through erosion.

Conservation practices: Needs the protection of long-term hay crops, which should be reseeded with a small grain when it is necessary to renew the stand.

Capability: Class IV because of combination of erosion hazard, slow drainage, and poor physical condition. Suited to the same crops as Cavode silt loam, 2 to 8 percent slopes. Capability unit IVe–3.

Cavode silt loam, 8 to 15 percent slopes (Ch).—This soil occurs on moderate slopes, frequently as bands or strips between better drained soils that developed from coarser materials. Included with it are some small areas of more poorly drained soils. These small areas are shown on the soil map by wet-spot symbols.

The total profile of this soil is generally thinner than that of the Cavode silt loam, 2 to 8 percent slopes. It averages about 30 inches in depth and seldom exceeds 36 inches. Also, because of the stratification of the parent shales, the soil is not so uniform in depth, color, drainage, and content of stone fragments. Erosion is moderate on most areas, but there has been slight or no erosion on about one-fourth of the total area. This one-fourth includes most of the wooded areas.

Conservation practices: Needs careful management of surface water to prevent erosion, drainage of wet spots, and the choice of crops that can stand wet periods.

Capability: Class III mainly because of erosion hazard, but also because of drainage problem. Suited to same crops as Cavode silt loam, 2 to 8 percent slopes, but requires careful management because of slope. Grains and legumes commonly damaged by winterkilling. Capability unit IIIe–5.

Cavode silt loam, 8 to 15 percent slopes, severely eroded (Ck).—This severely eroded soil has lost nearly all of its original silt loam surface layer. Gullies, normally shallow but hard to obliterate, have developed in the silty clay subsoil.

The soil profile is similar to that of the Cavode silt loam, 2 to 8 percent slopes, except that it is thinner. Normally it is only about 30 inches, although it varies from 24 to 40 inches. The 5- to 6-inch plow layer is grayish-brown to dark grayish-brown heavy silt loam. It consists of material from the upper subsoil blended with remnants of the original surface soil. In areas plowed within the last 6 to 8 years, the plow layer often contains streaks and spots of pale-brown or yellowish-brown subsoil not yet blended with the surrounding materials. Erosion is severe in all areas.

Conservation practices: Needs protection of close-growing crops. The hay crops ordinarily should be reseeded with a small grain, without an intervening row crop. Two plowings, with tillage between, will destroy most of the improved structure made by the long-term hay. Loss of structure makes it hard to get a good seedbed and a successful reseeding of the hay crop.

Capability: Class IV because of erosion hazard, slow internal drainage, and poor physical condition of plow layer. Suited to close-growing crops, hay, and small grains. Capability unit IVe–3.

Cavode silt loam, 15 to 25 percent slopes (Cl).—This soil ordinarily occurs as strips and bands on slopes where clay shale outcrops. In addition to the mapped areas, there are many streaks of this soil that are too small to separate from the associated better drained soils on the hillsides. Included on the map are about 300 acres of channery and shaly soil where coarse

fragments make up 15 to 25 percent of the surface soil. This soil has a profile similar to that of Cavode silt loam, 2 to 8 percent slopes. It is naturally thinner. The total soil depth is generally less than 36 inches. The soil contains some sandy and silty materials and fragments of stone derived from associated Dekalb and Gilpin soils.

Although it occurs on moderately steep slopes and has rapid surface drainage and a high erodibility, this soil has slow internal drainage. The erosion hazard is high.

Conservation practices: Cultivation should be done only when necessary to reseed.

Capability: Class IV because of erosion hazard and drainage problem. Some included areas with even poorer drainage are marked by wet-spot symbols. Best adapted to production of long-time hay or pasture. Capability unit IVe–3.

Cavode silt loam, 15 to 25 percent slopes, severely eroded (Cm).—This soil has been eroded to the extent that it has lost most, or all, of its original silt loam surface soil. Also, much of it has been damaged by gullies. The soil profile is similar to that of the Cavode silt loam, 2 to 8 percent slopes, except it is thinner, and the plow layer is a heavy silt loam. The surface layer has poor physical properties. It puddles easily and clods when plowed. This soil is severely eroded in all areas.

Capability: Class VII because of high erosion hazard, slow internal drainage, and poor tilth. The most practical use normally is for trees or other permanent vegetation that does not require use of farm machinery for maintenance. Much of the soil, however, occurs in small areas associated with other soils and is therefore cultivated with them. Capability unit VIIe–1.

Cavode silt loam, 25 to 35 percent slopes, eroded (Cn).—This soil covers a very small area. It is similar to Cavode silt loams on milder slopes except for being thinner. Ordinarily it is not more than 30 inches deep to slightly weathered clay shale. The soil contains coarser materials and fragments of sandstone and shale derived from associated Dekalb and Gilpin soils.

Included with this soil are a few acres of better drained soil not so strongly mottled in the subsoil. Also included are a few acres of poorly drained soil, which are shown on the map by wet-spot symbols. Erosion is slight or none in most wooded areas. Most of the cleared areas are moderately to severely eroded.

Capability: Class VII because of steepness of slope and slow internal drainage. Capability unit VIIe–1.

Cavode silt loam, concretionary variant, 0 to 2 percent slopes (Cd).—This soil differs from other Cavode silt loams because it developed from clay shales that contained material from iron-bearing Vanport limestone. This is a thin nodular limestone that has many iron nodules inside it or just above it. The soil is acid except where it is in immediate contact with the limestone. The content of bases is somewhat higher than for other Cavode soils.

This soil is associated with Wharton silt loam, concretionary variant, in the western part of the county. The profile is similar to that of the Cavode silt loam, concretionary variant, 2 to 8 percent slopes. It differs in occurring on nearly level slopes where surface drainage is slow. Erosion is generally slight.

Capability: Class II because of slow internal drainage. Capability unit IIw–1.

Cavode silt loam, concretionary variant, 2 to 8 percent slopes (Cg).—This soil occurs in the western part of the county in areas underlain by iron-bearing Vanport limestone. It was derived from clay shales that had been locally affected by the limestone and the iron concretions associated with the limestone. The soil occurs mostly in bands and on benches underlain by the Vanport limestone.

Profile of a cultivated area:

0 to 7 inches, dark to very dark grayish-brown (wet) to light brownish-gray (dry) silt loam; moderate fine granular structure; friable when moist; contains a few coarse sandstone fragments.

7 to 10 inches, yellowish-brown, fine-textured silt loam with some faint mottlings of gray; moderately well developed medium subangular blocky structure; acid.

10 to 40 inches, mottled light yellowish-brown, gray, and strong-brown silty clay loam; strongly developed medium blocky structure; blocks arranged one above the other in prismatic columns; firm when moist and somewhat plastic when dry; blocks shrink and become hard as they dry; a coating of gray and weak-red clay on blocks, and also some coatings of iron and manganese; layer contains some small concretions of iron and of manganese.

40 to 48 inches, strongly mottled gray and strong-brown silty clay or clay; coarse blocky structure; contains more iron concretions than horizon above; plastic when wet, very firm when moist; strongly acid; total depth of this soil profile may be considerably less than 48 inches.

48 inches +, clay becomes grayer and has fewer brown mottlings; neutral, or in places calcareous; some nodules and boulders of limestone.

In the few wooded areas where the soil has not been disturbed, the topmost 3 inches is very dark grayish-brown, very friable granular silt loam. The next 4 or 5 inches is yellowish-brown silt loam with a weak fine platy structure. Erosion is generally moderate. Some areas show only slight erosion or are not eroded.

Conservation practices: Internal drainage is slow and is classed as somewhat poor. The soil needs (1) diversion of surface water for erosion control and improved drainage and (2) maintenance of organic matter to preserve the structure and good tilth of the surface layer.

Capability: Class II because of moderate risk of erosion and retarded drainage. Soil well suited to the same general crops as the Cavode soils that do not have concretions but is naturally somewhat more productive. Capability unit IIe–6.

Cavode silt loam, concretionary variant, 8 to 15 percent slopes (Cgc).—Except for its stronger slopes this soil is similar to Cavode silt loam, concretionary variant, 2 to 8 percent slopes. It occurs as narrow strips and patches. Erosion is moderate in most areas.

Capability: Class III because of risk of erosion and somewhat poor drainage. Capability IIIe–4.

Cavode stony silt loam, 2 to 15 percent slopes (Co).—Except for its wider slope range and the many sand-

stone boulders on the surface and throughout the profile, this soil is similar to the wooded areas of Cavode silt loam, 2 to 8 percent slopes. Removal of the boulders is too expensive to make tillage practical. They are a residue of sandstone strata that cap the clay shale in many places.

Capability: Class VI because of stoniness, slope, and somewhat poor natural drainage. Best suited to trees or, if cleared, to pasture. Capability unit VIw–1.

Cavode stony silt loam, 15 to 30 percent slopes (Cp).—This soil is similar to the Cavode stony silt loam, 2 to 15 percent slopes, except for having steeper slopes and a shallower profile. Within single areas the profile of the soil varies more than that of more gently sloping soil. Considering this soil as a whole, however, its profile has about the same range in drainage and stoniness as Cavode stony silt loam, 2 to 15 percent slopes.

Capability: Class VI because of slope, stoniness and somewhat poor drainage. Capability unit VIe–2.

Clymer Series

In the Clymer series are deep, well-drained upland soils that have developed on sandstone, siltstone, and shale. The parent materials are chiefly fine sandstone and siltstone. These soils occur mostly in the northeastern part of the county on smooth ridges and moderate slopes. They are also on slopes in other parts of the county where strata of sandstone are exposed. Associated with the Clymer soils are the generally less well developed or shallower Dekalb, the moderately well drained Cookport, the poorly drained Nolo, and the very poorly drained Lickdale soils.

The native vegetation is mixed hardwoods, with a few white pines and hemlocks. White, red, and chestnut oaks, ash, black cherry, red and sugar maples, hickory, and dogwood are common trees. There are a few cucumber-magnolias and basswoods, as well as shadbush, sassafras, and ironwood. Some mountain-laurel is in the understory of the forest.

The total area of the Clymer soils is about 6½ square miles. Of this, 54 percent is cropped, 13 percent is idle, 3 percent is pastured, and 29 percent is wooded. Less than 1 percent is in urban and industrial uses.

These soils are favorable for agriculture because of depth, good drainage, and desirable texture and structure. The good aeration and the moderately high moisture-holding capacity make these soils particularly suitable for potato growing. They are naturally acid and thoroughly leached, so that plant nutrients must be supplied to obtain high productivity.

Clymer channery loam, 0 to 5 percent slopes (Cr).—This entire soil is acid. Following is a profile in a cultivated area:

0 to 7 inches, dark grayish-brown channery loam or light silt loam of weak, crumbly, medium granular structure; friable and easily tilled when moist; sandstone fragments ½ to 6 inches across make up 15 to 25 percent of plow layer.

7 to 10 inches, brown channery loam or light silt loam; weak platy structure; readily crumbles to medium granules, which, in turn, break down to individual soil grains.

10 to 20 inches, yellowish-brown channery silt loam or heavy silt loam; breaks into fine irregular blocky lumps that are only moderately well defined; abundant pore spaces between lumps and fine pores within lumps; friable over wide range of moisture conditions; plastic when very wet.

20 to 42 inches, yellowish-brown channery silt loam; coarser structure than overlying layer; weakly aggregated and lots of pore spaces.

42 inches +, yellowish-brown loam; amount of coarse sandstone fragments increases with depth; total depth varies from 32 to 50 inches.

In most places, there is slight erosion on the gentle smooth slopes. Erosion is moderate on some of the sloping open areas.

Conservation practices: On slopes sufficient for runoff to concentrate, farming should be across the slope and on the contour so as to avoid erosion by holding water until it soaks into the soil. Management that maintains organic matter or restores it to normal levels helps keep a working reserve of plant nutrients in this soil, which is readily leached.

Capability: Class I except where risk of erosion has been proved. Well suited to general farm crops and especially to potatoes. Capability unit I–1.

Clymer channery loam, 5 to 12 percent slopes (Cs).—This soil occurs on rolling ridgetops and broad gentle slopes. It is similar to Clymer channery loam, 0 to 5 percent slopes, but slightly shallower in cultivated areas. In most areas erosion is moderate, and in wooded areas it is none or slight.

Management needs: Needs erosion control and conservation of rainfall; maintain a surface that will hold water where it falls until it infiltrates.

Capability: Class II because of erosion hazard. Well suited to general farm crops and especially good for potatoes. Capability unit IIe–1.

Clymer channery loam, 12 to 25 percent slopes (Ct).—This soil occupies rolling hilltops and slopes adjacent to smooth hilltops. Its slopes range from 12 to 25 percent, but most of its acreage is near the lower limit.

The soil is similar to the Clymer channery loam, 0 to 5 percent slopes, but is somewhat shallower. Depth to the bottom of the subsoil averages 36 inches, but the range is from 30 to 40 inches. Included are some areas where coarse fragments make up less than 15 percent of the surface soil. Erosion is mostly moderate in cleared areas.

Conservation practices: Needs control of surface water by contour cultivation to obtain maximum infiltration and to prevent erosion.

Capability: Class III. Suited to general farm crops used in rotations that provide close-growing cover at least two-thirds of the time. Capability unit IIIe–1.

Clymer loam, 0 to 5 percent slopes (Cu).—This soil is similar to Clymer channery loam, 0 to 5 percent slopes, except that it is developed on softer more uniform sandstone. There are few coarse sandstone fragments in the soil. Some spots of sandy loam are included. Internal permeability is good, and the mois-

ture-holding capacity is moderately high. Erosion is slight to moderate.

Conservation practices: Needs contour cultivation to hold water until it infiltrates.

Capability: Class I except for some eroded areas, which are in class II. Capability unit I–1.

Clymer loam, 5 to 12 percent slopes (Cv).—This soil is similar to Clymer channery loam, 5 to 12 percent slopes, except that it has developed on softer sandstones. Because these sandstones break down so completely, there are few coarse sandstone fragments in the soil. The soil varies in sandiness. Some spots have a sandy loam surface texture. Erosion is mostly moderate except in wooded areas.

Conservation practices: Needs protection from erosion by contour cultivation to hold the water until it infiltrates. Water-holding capacity is good.

Capability: Class II because of erosion hazard. Well adapted to general farm crops, especially potatoes. Capability unit IIe–1.

Cookport Series

Cookport soils are deep moderately well drained loam and silt loam upland soils that developed on acid sandstone and siltstone. They occur on broad, gently to moderately sloping ridgetops extending from the town of Clarion to the northeastern corner of the county. Smaller areas are scattered in other parts. These soils are associated with the well drained Dekalb and Clymer, the poorly drained Nolo, and the very poorly drained Lickdale soils.

The native vegetation was mixed hardwoods, with some white pines and hemlocks. White and red oaks and red maple are the principal trees in second-growth forests. Scarlet and chestnut oaks, black cherry, hickory, sassafras, and shadbush also are common.

Cookport soils, to depths of 20 to 30 inches, have desirable physical properties that make them a good medium for growth of shallow-rooted plants. The tight, firm, mottled slowly permeable layer in the lower subsoil resists root penetration and therefore limits development of roots at lower depths. Some tree roots follow cracks and holes through this horizon, but their total effect is slight. The slow permeability of this layer causes seasonal, temporary waterlogging of higher, more open layers. In extremely wet seasons the whole soil becomes saturated, which results in serious injury to crops. The entire soil and underlying rock are acid and comparatively low in plant nutrients. Liming and fairly heavy fertilizing are necessary for any general agricultural use of the soil.

The total area of Cookport soils is more than 83 square miles. Of this area 56 percent is wooded, 28 percent is cropped, 11 percent is idle, and 4 percent is pastured. Towns and various industrial and recreational sites occupy less than 1 percent.

Cookport channery loam, 2 to 8 percent slopes (Cw).—Coarse fragments of sandstone make up from 15 to 25 percent of this soil. They range in size from pieces ½ inch in diameter to pieces 6 to 8 inches long and 2 inches thick. The texture of the soil varies somewhat, and some areas of channery sandy loam and channery fine sandy loam are included. About 4 percent of this soil has slopes of less than 2 percent.

Profile in a cultivated area:

0 to 8 inches, dark grayish-brown channery loam of weak fine granular structure; very friable.

8 to 18 inches, yellowish-brown channery silt loam or heavy loam; medium subangular blocky structure; many coarse pore spaces between blocks; friable when moist, slightly hard when dry.

18 to 22 inches, structure becomes more blocky and more closely packed; little change in color except faint mottling in some places.

22 to 40 inches, mottled yellowish-brown, light brownish-gray, and strong-brown channery heavy silt loam or silty clay loam; mottling becomes stronger with depth; strong medium blocky structure; dense and very firm when moist and hard when dry; some pores, but a general impression of dense packing; some platiness toward bottom of layer.

40 inches +, partially weathered yellowish-brown or gray sandstone; in places some stony loam soil material between the stones; stony loam material may be 50 to 60 inches deep to bedrock.

In wooded areas the surface is covered with 1 to 2 inches of organic matter consisting of partly rotted hardwood leaves, which overlie ½ inch of well-rotted leaf mold. In these areas the upper part of the mineral soil, to a depth of 3 inches, is very dark brown channery loam. It is very friable and is full of fine roots. From 3 inches to 8 or 10 inches there is brown channery loam with moderately well developed subangular blocky structure. There is some flattening of the blocks, which suggests a platy structure. This last-named layer is friable when moist.

Cookport channery loam, 2 to 8 percent slopes, is permeable down to the hard layer in the subsoil. The natural drainage is moderately good, but the soil is seasonally wet because the lower subsoil is slowly permeable. The slowly permeable layer is at a depth of 20 inches in some areas and at as much as 36 inches in others.

Some small areas of shallower soil are included with Cookport channery loam, 2 to 8 percent slopes. Here the mottled firm horizon is much thinner than normal, and bedrock is 30 inches from the surface. There is moderate sheet erosion in most cleared areas.

Conservation practices: Needs removal of excess surface water by diversions to provide some degree of drainage and to reduce erosion. Rows of intertilled crops should be planted on a definite but slight grade to prevent ponding without causing erosion. Tile drainage is needed for some spots where water concentrates or seeps out of the rock.

Capability: Class II because of erosion hazard and moderately good drainage. Suitable for most general crops. In some seasons alfalfa, potatoes, and winter grains are damaged by the high water table. Capability unit IIe–6.

Cookport channery loam, 8 to 15 percent slopes (Cx).—This soil is similar to Cookport channery loam, 2 to 8 percent slopes, but in cultivated areas it is a few inches shallower. In areas where most of the surface soil has been lost through erosion, large sandstone fragments are on the surface and in the plow layer.

Erosion is mostly moderate, except in wooded areas; a small part is severely eroded and has lost nearly all of the original surface soil.

Conservation practices: Cultivated areas need careful management of surface water to control erosion and to provide some degree of drainage.

Capability: Class III because of erosion hazard and moderately good drainage. Capability unit IIIe–4.

Cookport channery silt loam, 0 to 2 percent slopes (Cy).—This soil occurs on broad upland flats underlain by sandstone. Erosion is slight or none on most of the soil but moderate in a few spots. In places some material eroded from higher areas has been deposited.

Management needs: Nearly level relief causes some surface ponding and slow runoff, so removal of surface water is a primary problem.

Capability: Class II because of only moderately good drainage. Suitable for many general farm crops. Potatoes, alfalfa, and winter grains normally will be damaged to some extent by ponding. Capability unit IIw–1.

Cookport channery silt loam, 2 to 8 percent slopes (Cz).—This soil occurs on smooth gently sloping uplands. Coarse fragments of sandstone, up to 6 or 8 inches in length, are scattered on the surface. By volume, these fragments make up about 20 percent of the soil mass. In the wooded areas there are a few sandstone boulders a foot or two in diameter.

This soil is strongly acid throughout, except where it has been limed. Natural drainage is moderately good, but the tight lower subsoil keeps the soil wet for some time after heavy rains.

Profile in a cultivated area:

0 to 8 inches, dark grayish-brown channery silt loam of weak fine granular structure; friable and easily tilled.
8 to 17 inches, yellowish-brown channery heavy silt loam; moderate, fine to medium, blocky structure; blocks irregularly shaped and not closely packed; friable and permeable to water and roots.
17 to 21 inches, yellowish-brown heavy silt loam; more distinct and more closely packed blocky structure than that of layer above; firm in place; slightly hard when dry.
21 to 40 inches, mottled yellowish-brown, light brownish-gray, and strong-brown channery silty clay loam; strong medium blocky structure, but is platy in the lower part; firm when moist and hard when dry; some yellowish-red and weak-red mottling, which becomes stronger and more distinct to depth of 30 inches, then becomes less.
40 inches +, layers of sandstone and shale.

The total depth of the soil to sandstone and shale ranges from 30 to 60 inches. In the deeper areas, partly weathered sandstone and siltstone is at depths of more than 40 inches, and some silt and fine sand are in the cracks or channels or appear as a coating on the stones. The depth to the mottled layer varies from 20 to 36 inches.

Erosion is mostly moderate in the cultivated areas. Internal drainage is moderately good, and surface drainage is adequate. The tight layer in the lower subsoil causes seasonal waterlogging of the entire profile.

Conservation practices: Soil should be protected from erosion by diverting water from long slopes and by stripcropping. A rotation should be used that keeps growing crops on the soil at least two-thirds of the time. Some tile drainage of seep spots is needed to supplement the other methods of water control already suggested.

Capability: Class II because of erosion and moderately good drainage. Soil is suited to most general farm crops, but the seasonally high water table limits use for potatoes, alfalfa, and winter grains. Capability unit IIe–6.

Cookport channery silt loam, 8 to 15 percent slopes (Cla).—This soil is similar to Cookport channery silt loam, 2 to 8 percent slopes, but it is slightly shallower in cleared areas because of greater erosion. Also, the depth to bedrock and the depth to the tight subsoil layer are more variable within individual areas. On the moderate slopes this soil occupies, any one area commonly has developed from several strata of bedrock of varying hardness and texture.

Erosion is mostly moderate in cultivated areas. Internal drainage is moderately good, and surface drainage is adequate. The tight layer in the lower subsoil causes seasonal waterlogging of the entire profile.

Conservation practices: Soil should be protected from erosion by diverting water from long slopes and by stripcropping. A rotation should be used that keeps close-growing crops on the soil at least two-thirds of the time. Some tile drainage of seep spots is needed.

Capability: Class III because of erosion hazard and moderately good drainage. Suited to most general farm crops, but the seasonally high water table somewhat limits use for potatoes, alfalfa, and winter grains. Capability unit IIIe–4.

Cookport channery silt loam, 15 to 30 percent slopes (Clb).—Except for having stronger slopes and shallower depth to bedrock, this soil is like Cookport channery silt loam, 2 to 8 percent slopes. The average depth to bedrock is about 30 inches, and all layers are somewhat thinner than in channery silt loam on slopes of 2 to 8 percent. Because the soil has normally developed from several strata of sandstone and shale of varying hardness, it is less uniform than soils on lesser slopes. The greatest acreage has slopes only slightly above 15 percent, but about 39 acres has slopes stronger than 25 percent.

Included with this soil is a small acreage where coarse sandstone fragments make up only 15 percent of the silt loam surface soil. Also included are some areas of more sandy soil. Erosion is none or slight in wooded areas but moderate in most cleared areas. A small acreage shows severe erosion.

Conservation practices: If cultivated, needs protection of close-growing crops; hay should be on the soil most of the time. When it is necessary to renew the stand, reseed the hay mixture in a crop of small grain. A clean-cultivated crop should not intervene between the plowing out of the old stand and reseeding of the new.

Capability: Class IV because of erosion hazard and moderately good drainage. Areas with slopes stronger than 25 percent should be kept in trees. Soil is moderately well suited to spring grains

and hay crops other than alfalfa. Capability unit IVe–3.

Cookport silt loam, 0 to 2 percent slopes (CIc).—This soil developed from more uniform or softer sandstone and siltstone, so it has only a moderate number of coarse fragments in the upper part. Otherwise, it is similar to Cookport channery silt loam, 0 to 2 percent slopes.

Capability: Class II because the tight lower subsoil moderately restricts drainage. Suited to the same crops as Cookport channery silt loam, 0 to 2 percent slopes, and has the same management problems. Capability unit IIw–1.

Cookport silt loam, 2 to 8 percent slopes (CId).—Except for having only a few coarse sandstone fragments, this soil is like Cookport channery silt loam, 2 to 8 percent slopes. It has developed on fairly uniform fine sandstone and siltstone that break down evenly in the process of soil formation. Erosion is about the same as for Cookport channery silt loam, 2 to 8 percent slopes.

Capability: Class II because of risk of erosion and moderately good drainage. Suitable for same crops as Cookport channery silt loam, 2 to 8 percent slopes, and needs the same kind of management. Capability unit IIe–6.

Cookport silt loam, 8 to 15 percent slopes (CIe).—This soil is similar to Cookport channery silt loam, 8 to 15 percent slopes, except for having only a moderate amount of hard fragment left by uneven weathering of the parent rock. Erosion is about the same as for Cookport channery silt loam, 8 to 15 percent slopes.

Capability: Class III because of erosion hazard and moderately good drainage. Suited to same crops as Cookport silt loam, 8 to 15 percent slopes, and because it has about the same risk of erosion and restriction on internal drainage, needs similar management. Capability unit IIIe–4.

Cookport stony silt loam, 0 to 15 percent slopes (CIf).—Many sandstone boulders, 8 to 30 inches in diameter, are on the surface of this soil and scattered throughout its profile. Except for the stones, the soil is like the wooded areas of Cookport channery silt loam, 2 to 8 percent slopes. It shows the same variation in depth, but its texture varies more. Some of the soil contains enough sand to be classed as a loam.

Capability: Class VI because of stoniness. The boulders make cultivation impractical, and removing the stones would be expensive. Only small areas of this soil in fields with nonstony soils are used for crops. In areas cleared of trees, pasture is the best use, because the stones are not numerous enough to prevent some improvement of pastures. Pastures should be limed and fertilized. The wooded areas have second-growth stands of high potential productivity. Forest is the best use for most of this soil. Capability unit VIs–1.

Cookport stony silt loam, 15 to 30 percent slopes (CIg).—Except for having many sandstone boulders 8 to 30 inches in diameter, this soil is similar to Cookport channery silt loam, 15 to 30 percent slopes.

Capability: Class VII because of stoniness and steepness of slopes. Well suited to forest. Some small areas included with other soils are used for crops or pasture or lie idle. Capability unit VIIe–1.

Dekalb Series

In the Dekalb series are upland soils that developed on acid sandstone and shale. They occur in all parts of the county, but most extensively in the northeastern part. The soils are associated with the well-drained, deep Clymer, the moderately well drained Cookport, the poorly drained Nolo, and the very poorly drained Lickdale soils. In some places they are also closely associated with Gilpin and Cavode soils, which are from finer textured materials. On lower slopes below the Dekalb soils are the Ernest and Brinkerton soils.

The native vegetation is mixed hardwoods, mainly white, red, chestnut, and scarlet oaks, red and sugar maples, and black cherry. Tulip-poplar, hickory, basswood, white and red pines, and hemlock are also present. Chestnut was formerly an important tree, and there are still some chestnut sprouts. Mountain-laurel, dogwood, shadbush, and seedling trees are the principal underbrush.

Except for the surface soil stained by organic matter, the layers in the Dekalb soils are varying shades of brown and yellowish brown. Textures range from sandy loam to loam, and included are some small areas of loamy sand and silt loam. Dekalb soils are permeable and well drained throughout. Relief ranges from level to extremely steep. About two-thirds of the acreage is stony. The rest is classed as channery, that is, the soils have flat fragments of sandstone on the surface and throughout the profile.

Dekalb soils have a moderate moisture-supplying capacity because they are medium to coarse textured throughout and generally have only moderate depth. In some locations, especially on lower slopes, their depth is greater because considerable material has accumulated. They are naturally strongly acid and are low in plant nutrients. The soils are suitable for forest but require heavy fertilization if they are used for crops or pasture.

The Dekalb soils cover 110 square miles. About 14 percent of the acreage is cropped, 5 percent is idle, 3 percent is in permanent pasture, 77 percent is forested, and less than 1 percent is in townsites or sites for industrial development or recreation. Nearly all the acreage of the stony soils is wooded.

Dekalb channery loam, 0 to 5 percent slopes (Da).—This soil has a profile similar to that for Dekalb channery loam, 5 to 12 percent slopes, the soil next described. Sheet erosion is slight to moderate in most cleared areas.

Capability: Class II because of moderately low water-supplying capacity and, on much of the area, moderate risk of erosion. In suitability for crops and management requirements, this soil is similar to Dekalb channery loam, 5 to 12 percent slopes, but erosion control practices are not so urgently needed. Capability unit IIe–5.

Dekalb channery loam, 5 to 12 percent slopes (Db).—Following is a profile of a moderately eroded cropped area of this soil:

0 to 8 inches, dark grayish-brown channery loam; weak fine granular structure that easily breaks to single grains; friable; easily tilled except for presence of sandstone fragments from ½ to 6 inches long and up to 2 inches thick on 15 to 30 percent of total acreage.
8 to 21 inches, yellowish-brown channery loam; contains slightly more clay and silt than surface layer; weakly developed subangular blocky structure; contains many sandstone fragments; friable; many large pores.
21 to 48 inches, broken pieces of sandstone coated with yellowish-brown loamy soil, which makes up about 10 percent of soil mass; plant roots penetrate along these streaks of soil; lower boundary is wavy and total depth to it varies between 21 and 48 inches.
48 inches +, solid bedrock, usually sandstone but sometimes shale.

In wooded areas the soil is a few inches deeper. The surface is covered with hardwood leaf litter and well-rotted tightly matted leaf mold. From the bottom of the leaf mold to a depth of 3 inches, the mineral soil is dark grayish-brown channery loam, very loose and friable. From 3 to 8 inches there is yellowish-brown channery loam of weak fine crumb structure. Erosion is mostly moderate in cropped areas and slight or none in wooded areas. Severely eroded areas make up about one-sixth of the total acreage. The severely eroded areas have lost 6 to 12 inches of the original surface soil, and the yellowish-brown channery subsoil forms most of the plow layer.

Conservation practices: If cultivated, needs contour farming, including contour stripcropping, which will hold water where it falls and reduce risk of erosion.

Capability: Class II because of risk of erosion and low moisture-supplying capacity. Severely eroded spots need special care. The soil is fairly well suited to many crops, but low moisture supply, acidity, and low fertility usually limit production. Cultivated areas require heavy applications of lime and fertilizer. Potatoes are well suited because the soil has excellent internal drainage and aeration. Capability unit IIe–5.

Dekalb channery loam, 12 to 25 percent slopes (Dc).—Aside from being slightly shallower, this soil is similar to Dekalb channery loam, 5 to 12 percent slopes. Loose, broken, partly weathered sandstone begins at a depth of about 18 inches. The range in depth is wide, however, and at the bottom of slopes there may be 30 to 36 inches of soil over the broken bedrock. Erosion is generally moderate in cleared areas.

Conservation practices: Needs the protection of close-growing crops for at least two-thirds of the time. Water should be controlled by careful contour stripcropping.

Capability: Class III because of erosion hazard and generally low water supply. Fair for many crops, but in many seasons yields are limited by low water supply. Lime is needed to overcome natural acidity, and fertilizer is required to build up fertility. Capability unit IIIe–3.

Dekalb channery loam, 12 to 25 percent slopes, severely eroded (Dd).—Erosion has removed all, or almost all, of the original surface layer from this soil. The stones left from the surface layer are concentrated in the plow layer. In some places the sandstone fragments form a pavement, which checks erosion until the soil is cultivated. After cultivation, fresh soil material is brought to the surface and is exposed to erosion. The soil is shallow to bedrock in nearly all places.

Capability: Class IV because of shallowness and severe erosion. Suitable for occasional cultivation but should be in hay crops at least four-fifths of the time. The most severely gullied spots are too broken for use as hayland and are best used for forest. Capability unit IVe–2.

Dekalb channery loam, 25 to 35 percent slopes (De).—This soil has a profile similar to that of the Dekalb channery loam, 5 to 12 percent slopes, but it is somewhat shallower to the broken, partly weathered sandstone bedrock. More than half of the acreage is wooded.

Profile in a wooded area:

0 to 3 inches, very dark grayish-brown channery loam.
3 to 6 inches, light yellowish-brown channery loam; weak fine crumb structure.
6 to 15 inches, brownish-yellow channery loam; some clay coatings on rock fragments and on weakly defined subangular blocks.
15 to 48 inches, mass of broken sandstone fragments; loamy soil in the cracks.
48 inches +, hard sandstone; lower boundary above rock is wavy and total depth to it ranges from 15 to 48 inches.

Erosion is mostly moderate in cleared areas but there has been noticeable erosion of skid roads in wooded areas.

Conservation practices: Needs the protection of close-growing cover. Slopes are too steep for practical or safe tillage.

Capability: Class IV because of steepness and shallowness. Best used for woodland. If cleared, soil will produce fair yields of hay and pasture under careful management. Capability unit IVe–2.

Dekalb channery loam, 25 to 35 percent slopes, severely eroded (Df).—This soil has lost all of its original surface soil. The plow layer contains many coarse rock fragments. In places the fragments form a pavement that checks further erosion. Erosion is severe. A few areas are severely gullied, but in most places the soil is too shallow to permit much gullying.

Capability: Class VII because of severe erosion, steepness of slopes, and shallowness. Soil is best used as woodland. Most of the small acreage now wooded is in areas that have been reforested. Capability unit VIIe–2.

Dekalb channery loam, 35 to 60 percent slopes (Dg).—Most of this soil is so steep it has had little cultivation; therefore, it is only slightly eroded. Erosion has been severe in the few areas that have been cultivated.

Capability: Class VII because of steep slopes and shallowness. Forest is the most practical use. Capability unit VIIe–2.

Dekalb channery sandy loam, 0 to 5 percent slopes (Dh).—Most of this soil is on broad ridgetops. Included with it in mapping are a few areas of channery loamy

sand near the eastern edge of the county and north of the Clarion River. The sandy areas are highly leached and very low in plant nutrients. Erosion is mostly slight.

Capability: Class II because of low moisture-supplying capacity. Capability unit IIe–5.

Dekalb channery sandy loam, 5 to 12 percent slopes (Dk).—This soil is well drained and permeable throughout. Plant roots penetrate the cracks, even in the lower horizons where sandstone fragments make up 90 percent of the material. The moisture-supplying capacity is low to moderate because the soil is sandy and shallow.

The soil is strongly acid and low in plant nutrients. Its capacity for holding lime and fertilizer is small, so moderate applications need to be made at short intervals.

Profile in a cultivated area:

0 to 8 inches, very dark grayish-brown (wet) to light brownish-gray (dry) channery sandy loam; weak fine granular structure; very friable and easily tilled, except for sandstone fragments, ½ to 8 inches in width and length and 2 inches in thickness, that make up 20 to 35 percent of the layer.

8 to 24 inches, brownish-yellow channery sandy loam or loam; contains slightly more clay than above layer; coarse sandstone fragments make up from 15 to 30 percent of layer; these modify structure so that weak platy and irregular small blocky aggregates are mixed in spaces around the stone fragments.

24 inches +, yellowish-brown and gray sandstone fragments; some sandy loam soil between the stones; frequently some clay coating on the stones; hard bedrock at depths ranging from 24 to 60 inches.

Included with this soil are several areas of channery loamy sand near the eastern edge of the county, north of the Clarion River. This more sandy soil is highly leached and very low in natural fertility. It resembles Leetonia stony sandy loam, except it lacks the large boulders. Erosion is moderate in most cleared and cultivated areas, and slight in wooded areas. Included are a few acres of severely eroded soil that has lost much of the fine material from the surface layer and now has an erosion pavement of sandstone fragments.

Conservation practices: Needs careful management to build up fertility and conserve water that falls during the growing season. Stripcropping should be done on the contour, and sod crops should cover the ground at least half of the time.

Capability: Class II because of shallowness and risk of erosion. Soil is fairly well suited to many crops, but low water-supplying capacity limits yields in most seasons. The open, well-aerated surface soil and subsoil favor potato growing. Capability unit IIe–5.

Dekalb channery sandy loam, 12 to 25 percent slopes (Dl).—This soil is similar to Dekalb channery sandy loam, 5 to 12 percent slopes, except that it occurs on steeper surfaces and is more variable in depth to bedrock. On lower slopes some areas are deep enough to have a moderate moisture-supplying capacity, even though they are sandy. Included with this mapping unit are a few acres of loamy sand near the eastern edge of the county. Erosion is moderate on about half of the acreage.

Conservation practices: Farmed areas need contour stripcropping to conserve rainfall where it falls and to control erosion. This soil should also have the protection of close-growing crops for at least three-fourths of the time. Frequent checks on fertility levels are needed because of rapid leaching.

Capability: Class III because of risk of erosion and low moisture-holding capacity. Fairly well suited to most farm crops, but production is limited in most seasons by the low moisture-holding capacity. The forested areas are fair for forest production but not so good as the Dekalb channery loams and stony loams. Capability unit IIIe–3.

Dekalb channery sandy loam, 12 to 25 percent slopes, severely eroded (Dm).—This soil has lost all, or nearly all, of the original plow layer through erosion. The plow layer now consists of a mixture of subsoil with extra sandstone fragments from the original surface soil. In many places the fragments make an erosion pavement that checks further erosion until the soil is stirred by cultivation and more fine material is brought to the surface. Most areas are severely eroded.

Conservation practices: Needs the protection of close-growing vegetation and contour cultivation most of the time. Soil should be plowed only when it is necessary to reseed hay or pasture. One small-grain crop in a rotation is about the safe limit.

Capability: Class IV because of erosion and low water-holding capacity. Suited only to crops that make a fairly dense cover and persist under rather unfavorable conditions. Capability unit IVe–2.

Dekalb channery sandy loam, 25 to 35 percent slopes (Dn).— This soil has steep slopes and is somewhat more variable in depth and texture than Dekalb channery sandy loam, 5 to 12 percent slopes. Depth to hard bedrock ranges from 15 to 60 inches. Erosion is slight on most wooded areas and severe on almost half of the cleared areas.

Conservation practices: Where cleared, needs the protection of a close-growing cover crop. Fair pasture can be produced by liming and fertilizing.

Capability: Class VI because of risk of erosion and low moisture-supplying capacity. Capability unit IVe–2.

Dekalb channery sandy loam, 35 to 60 percent slopes (Do).—This soil is similar to Dekalb channery sandy loam, 5 to 12 percent slopes, but it occurs on very steep slopes, is somewhat more variable in depth, and on the average is shallower. The depth to hard bedrock ranges from 12 to 48 inches, often in short distances, because the soil has developed over rocks of varying hardness. The texture of the surface soil also varies from fine sandy loam to loamy sand, depending on the kind of sandstone from which the parent material weathered. Erosion is slight or none in wooded areas and severe on about half of the cleared areas.

Capability: Class VII because of erosion hazard and shallowness. Soil is suitable only for forest, and most of it remains forested. Only small areas are included in cleared fields. Capability unit VIIe–2.

Dekalb loam, 0 to 5 percent slopes (Dp).—This soil is similar to Dekalb channery loam, 0 to 5 percent slopes, except that less than 15 percent of the surface soil is made up of coarse sandstone fragments. The soil is easier to till because it has fewer fragments.

Capability: Class II because of shallowness and low moisture-supplying capacity. Suitable for the same crops and needs the same management as Dekalb channery loam, 0 to 5 percent slopes. Capability unit IIe–5.

Dekalb loam, 5 to 12 percent slopes (Dr).—This soil is similar to the Dekalb channery loam, 5 to 12 percent slopes, except that usually less than 15 percent of the surface soil consists of coarse fragments of sandstone. This makes it easier to till than the channery loam. Erosion is moderate in most cleared areas.

Capability: Class II because of risk of erosion and low moisture-supplying capacity. Suited to some crops and needs the same management as Dekalb channery loam, 5 to 12 percent slopes. Capability unit IIe–5.

Dekalb loam, 12 to 25 percent slopes (Ds).—This soil is similar to Dekalb channery loam, 12 to 25 percent slopes, except that most of it has less than 15 percent of coarse rock fragments and, as a result, is easier to till. Erosion is moderate in cleared areas and slight in forested areas.

Capability: Class III because of erosion hazard and shallowness. Suitable for the same crops and needs the same management as Dekalb channery loam, 12 to 25 percent slopes. Capability unit IIIe–3.

Dekalb stony loam, 0 to 25 percent slopes (Dt).—This soil has sandstone boulders 3 to 4 feet in diameter scattered on the surface and throughout the profile. Within the soil, the proportion of boulders and of small sandstone fragments increases below 30 inches. Profile:

0 to 2 inches, very dark grayish-brown loam or channery loam; weak medium granular structure; very friable; this layer covered by ½ to 1 inch of rotting hardwood leaves and thin mat of leaf mold tied together with fungus mycelia and many fine tree roots.
2 to 10 inches, grayish-brown loam or channery loam; faintly developed medium platy structure that readily breaks down to weak medium granular.
10 to 48 inches, yellowish-brown channery loam; contains slightly more clay than layer above; very weak, poorly developed, subangular blocky structure.
48 inches +, bedrock begins at depths of 30 to 48 inches, but may be much deeper.

The soil between coarse fragments is friable and porous, and permeability to water, roots, and air is excellent. The soil has moderate to low moisture-supplying capacity, depending somewhat on the proportion of coarse fragments. It is strongly acid and low in plant nutrients. Much of the capacity for storing nutrients is concentrated in the organic layers on and in the surface soil. Texture varies, and some sandy loams and some silt loams are included with the prevailing loam. Erosion is slight or none in forested areas. Erosion is confined to gullying of skid roads and to sheet erosion of areas that have been heavily browsed by livestock or at some time completely denuded by fire. About a square mile of open land has moderate erosion.

Conservation practices: Wooded areas need protection from fire and grazing. Also, harvesting of timber should be planned so that gully erosion will not result from poorly laid out skid trails and truck roads. Stoniness, though not extreme, is too much to allow cultivation without expensive stone clearing.

Capability: Class VII because of stoniness and shallowness. Most of this soil has remained in forest. It is moderately good forest land from a production standpoint. Capability unit VIIe–1.

Dekalb stony loam, 25 to 35 percent slopes (Du).—This soil is similar to Dekalb stony loam, 0 to 25 percent slopes, except on the average it is shallower to bedrock. Depth to bedrock ranges from 20 to 60 inches, and occasionally ledges of bedrock show at the surface. This soil occurs on the sides of valleys in the northeastern part of the county and in scattered spots elsewhere.

Capability: Class VII because of stoniness, shallowness, and risk of erosion if cleared. Suitable only for forest; fairly productive of forest, but not so good as some of the associated soils. Nearly all of this soil is forested. Capability unit VIIe–1.

Dekalb stony loam, 35 to 75 percent slopes (Dv).—This is the very steep soil along valley walls in the northeastern part of the county and on scattered hillsides in other parts. It is similar to Dekalb stony loam, 25 to 35 percent slopes, except for having a shallower profile. Depth to bedrock ranges from 12 to 60 inches. The texture of this soil and degree of stoniness are also variable. Included along with the dominant loam are spots and streaks of silt loam and sandy loam. There are very stony spots and also small areas that are nearly free of boulders.

Capability: Class VII because of stoniness, steepness of slope, and shallowness of profile. Soil is suitable for forest, and almost all of it remains forested. Capability unit VIIe–1.

Ernest Series

The Ernest series consists of moderately well drained to somewhat poorly drained soils on gentle to moderately steep lower slopes. These soils occur throughout the county in bands and isolated areas below uplands on which there are Gilpin, Dekalb, and Cavode soils. The Ernest soils are associated with the well-drained soils of the Shelocta series, the poorly drained soils of the Brinkerton series, and the very poorly drained soils of the Lickdale series. They differ from the somewhat similar Cavode soils in being generally a little better drained, in being deeper to bedrock, and in not having developed from the underlying rock. They have developed on soil material that has slid down or has washed from the higher slopes. This movement of soil material took place so long ago that the soils now have a well-expressed profile.

The native vegetation was mixed hardwoods, including white oak, hickory, red and sugar maples, black cherry, elm, beech, tulip-poplar, ironwood, shadbush, dogwood, and sassafras. The underbrush consists of mountain-laurel, rhododendron, and spicebush.

The total area of Ernest soils is 70 square miles. About 41 percent is cropped, 12 percent is idle, 15 percent is in permanent pasture, and 31 percent is wooded. More than 1 percent is used for townsites and other nonagricultural purposes. The location of these soils in valleys near streams but above the flood level accounts for their being favored for townsites and farm homes. The fairly large percentage in pasture is accounted for by their location near the water supply on many farms and by the fact that these soils have a fairly good moisture supply during summer (fig. 6).

FIGURE 6.—Improved pasture on moderately eroded Ernest silt loams. Slopes of 2 to 8 percent in foreground, and slopes of 8 to 15 percent in area beyond trees in background.

The soils of the Ernest series are moderately permeable and have a moderately high moisture-storing capacity. Because they are on moderate lower slopes, they receive runoff and seepage water from higher slopes. Drainage across these areas has resulted in ravines and intermittent streams that cut up the otherwise uniform slopes. Surface drainage is generally good, but internal drainage of the lower subsoil is slow enough to cause seasonal waterlogging, which harms some crops. These soils are somewhat acid. They are moderately low in plant nutrients, but their capacity to store these elements and release them to plants is good.

Ernest silt loam, 0 to 8 percent slopes (Ea).—On the surface and throughout this soil are some fragments of sandstone 6 or 8 inches in length and 2 inches thick. These fragments generally make up less than 15 percent of the total soil mass, and in many places only about 5 percent. They are more numerous adjacent to uplands of Dekalb soils than in other areas. A few areas have as much as 20 percent of coarse fragments. Some areas have many fine shale chips on the surface. These chips are partly the result of recent deposition from adjacent slopes and are partly a residue from hard thin shale.

Most of this soil is on gentle slopes of 2 to 8 percent. A small amount of nearly level soil is included.

The soil is moderately acid throughout, except where it has been limed. It has a moderate capacity to store and deliver plant nutrients.

Profile in a cultivated area:

0 to 8 inches, dark grayish-brown easily crumbled silt loam of weak fine granular structure; friable and easily tilled when moist.

8 to 18 inches, yellowish-brown heavy silt loam; moderately well developed subangular blocky structure; permeable and well aerated because of large pore spaces between blocks; friable when moist and only slightly plastic when wet; lower part of horizon is more distinctly blocky than upper part, and blocks are more angular; depth to lower limit of horizon varies from 12 to 30 inches.

18 to 36 inches, mottled yellowish-brown, brown, gray, and strong-brown heavy silt loam or silty clay loam; strong, stable, medium blocky structure; blocks are arranged in irregular columns; firm when moist and moderately plastic when wet; near bottom of horizon, some iron and manganese coatings on some of the surfaces.

36 to 48 inches, mottled yellowish-brown and gray heavy silt loam or silty clay loam; strong coarse blocky structure; blocks arranged in vertical columns and faces coated with clay; firm in place and moderately plastic when wet; depth to bedrock ranges from 48 to 120 inches.

There is moderate sheet erosion in cleared areas. About 9 percent of the total acreage is gullied, one of the highest percentages in the county for a moderately eroded soil. The degree of gullying, however, is not excessive. Water flowing across this soil from the uplands causes the erosion and gullying.

Conservation practices: To obtain best production, it is necessary to reduce erosion and improve drainage by diverting excess water on the higher slopes before it can reach this soil. Stripcropping is needed on large fields; the strips should be on a grade that will allow water to move slowly along the crop rows, yet at a rate that will prevent ponding. In addition to diversion of water on slopes, some drainage normally will be needed for seep spots and wet-weather springs. Drainage is most needed on a few hundred acres of nearly level soil.

Grazing of wooded areas should be avoided, as they produce little grass, and the trampling destroys both seedling trees and the dense growth of roots near the surface.

Capability: Class II because of risk of erosion and moderate drainage problem. The soil is well suited to most farm crops if surface water is controlled and seep spots are drained. Without drainage, alfalfa and winter grains are often damaged in parts of a field. Liming and fertilization are important if full returns are to be obtained. Pasture yields can be greatly increased by applying lime and fertilizer. It is important to keep livestock off pastures when the soil is waterlogged. Capability unit IIe-6.

Ernest silt loam, 0 to 8 percent slopes, severely eroded (Eb).—This soil has lost all, or nearly all, of its silt loam surface layer. Most areas are gullied. About a third of the acreage has deep gullies that have cut

down to the underlying material and are serious obstacles to cultivation. Areas not gullied, and the strips between gullies, have a plow layer containing much of the heavier subsoil material. When moist, this plow layer is less friable than the original surface layer, and when dry, it is hard and cloddy.

Conservation practices: Needs the same conservation practices as Ernest silt loam, 0 to 8 percent slopes, but they are needed more urgently and should be more intensively applied. Control of gullying and reclamation of gullied areas are particularly needed. Organic matter should be restored to the surface soil.

Capability: Class III because of serious erosion and moderate drainage problem. The soil is fairly well suited to most farm crops after partial restoration, but it needs more than the usual amount of protection from sod-forming crops. Capability unit IIIe–4.

Ernest silt loam, 8 to 15 percent slopes (Ec).—This soil is rather thoroughly dissected by surface drains and wet-weather streams. Included are a few areas that have numerous sandstone fragments, some small well-drained areas, and many small spots over a relatively small acreage that are poorly drained because of the seepage. Erosion is moderate in nearly all cleared areas. About 17 percent of total area is affected by shallow gullies. This is a very high rate of gullying, compared to that for other soils of the county.

Conservation practices: Management practices are the same as for the more gently sloping soil, except they are more urgently needed and should be more intensively applied. More protection from close-growing crops is needed. Stripcropping should be practiced wherever there is room for two strips. Pasture needs protection from erosion, and it should not be grazed during wet seasons.

Capability: Class III because of risk of erosion and drainage problems. Soil is well suited to most farm crops, but alfalfa and winter grains are often spotty unless surface water and seepage are somewhat controlled. Capability unit IIIe–4.

Ernest silt loam, 8 to 15 percent slopes, severely eroded (Ed).—This soil has lost all, or nearly all, of its original surface soil through erosion, and nearly all of the areas have been affected by gullies. The present surface soil mostly consists of subsoil material that has been mixed with remnants of the original surface soil. This soil is less friable than Ernest silt loam, 8 to 15 percent slopes, and is normally cloddy when plowed. Erosion is severe.

Conservation practices: Needs same management practices as Ernest silt loam, 0 to 8 percent slopes, severely eroded; also needs almost full-time protection of sod-forming crops.

Capability: Class IV because of erosion and moderately good drainage. Soil should be kept in hay or pasture as much as possible. When it is necessary to break up a pasture because the stand has become thin, reseeding should be done as soon as practical. A few of the worst gullied areas should be reforested. Capability unit IVe–3.

Ernest silt loam, 15 to 30 percent slopes (Ee).—This soil has a slope range of 15 to 30 percent, but only about 3 percent of it has slopes greater than 25 percent. The soil normally has more loose fragments of sandstone and siltstone throughout the profile than Ernest silt loam, 15 to 30 percent slopes. In a small area, coarse fragments make up more than 20 percent of the soil. Erosion is moderate in most areas and severe in about one-seventh of the total area. In the severely eroded areas the subsoil is exposed and gullies are numerous.

Conservation practices: The soil needs the protection of close-growing crops most of the time and ought to be protected from the heavy crossflow of water from higher slopes.

Capability: Class IV. Less eroded areas are suitable for hay or pasture, which can be reseeded occasionally. Some of the more severely eroded areas should be kept in pasture or woods because plowing would be impractical. Capability unit IVe–3.

Ernest stony silt loam, 2 to 15 percent slopes (Ef).—Except for stoniness, this soil is similar to Ernest silt loam, 0 to 8 percent slopes. Most of the soil has never been plowed. Sandstone boulders, 8 to 48 inches in diameter, are scattered on and through the soil in numbers that make plowing or cultivation impractical.

In wooded areas the surface soil is covered with a litter of rotting hardwood leaves, under which there is a mat of well-rotted leaves containing many fine tree roots. The top layer of the mineral soil, about 3 inches thick, is a friable very dark grayish-brown silt loam of weak medium granular structure. From 3 to 8 inches, the soil is pale-brown silt loam in which aggregates of weak medium platy and granular structure are mingled. Below this, the soil horizons are similar to those described for Ernest silt loam, 0 to 8 percent slopes.

Capability: Class VI because of stoniness and moderately good to somewhat poor drainage. Ninety-two percent of the soil is wooded. The soil is too stony for cultivation. It is generally suitable for pasture, but there is the difficulty of seeding, liming, and fertilizing among the stones. Capability unit VIs–1.

Ernest stony silt loam, 15 to 30 percent slopes (Eg).—Except for having many sandstone boulders 8 to 48 inches in diameter, this soil is similar to Ernest silt loam, 15 to 30 percent slopes. Most of this soil shows no erosion because it never has been cleared. Erosion is severe in the small cleared areas.

Capability: Class VII because of stoniness, strong slopes, and moderately good to somewhat poor drainage. Best suited to trees, and 92 percent of it is wooded. Capability unit VIIe–1.

Gilpin Series

In the Gilpin series are shallow to moderately deep well-drained upland soils that developed on mixed acid material weathered from shale and sandstone. In their parent material, the proportion of silty shale and very fine sandstone is high.

The soils occur on hillsides and ridgetops throughout the county and are the principal soils in the southern half. They are associated with the deep, well-drained Rayne soils on similar material, with the Cavode and Armagh soils on clay shales, and with the Dekalb and Cookport soils on more sandy material. Ernest and Brinkerton soils frequently occur on slopes below the Gilpin soils.

The native cover was mixed hardwoods, with a few white pines and hemlocks. Wooded areas now have second- and third-growth stands in which white and red oaks, red maple, and dogwood predominate. The stand also includes some chestnut oak, scarlet oak, hickory, black cherry, ash, tulip-poplar, beech, sassafras, black birch, shadbush, and thornapple. The undergrowth includes mountain-laurel, huckleberry, and seedlings of the forest trees. Most of the idle land and some of the pastures have fairly dense stands of blackberry, thornapple, sumac, sassafras, and shrub dogwood and virburnum. The growth on idle land and neglected pastures is mostly povertygrass *(Danthonia spicata)* and broomsedge (*Andropogon virginicus*), with some bluegrass and a little whiteclover.

The soils vary in texture, depth, and number of coarse fragments, and degree of profile development. This variation results because the underlying shale and sandstone occurs in nearly horizontally bedded narrow bands. Because the soils are shallow or only moderately deep, differences in parent material have been only partly obscured. Variation in texture, depth, number of coarse fragments, and degree of profile development are characteristic of Gilpin soils. The differences often show within small areas and are strongly expressed in these short distances.

Water-supplying capacity is limited by the shallowness of the soils and their moderate subsoil development. The underlying shale and sandstone, however, are normally partly weathered. To some extent, roots of trees and perennial crops penetrate along cracks in the broken rock. Because the soil is open and well aerated, drainage is a problem only in seep spots and around wet-weather springs. The soil is naturally acid and only moderately well supplied with plant nutrients. Its capacity to hold these elements for release to plants is moderately high, so the response to lime and fertilizer is good.

Gilpin soils are extensive. They cover a total of 134 square miles in the county. About 42 percent is used for crops, 14 percent is idle, weedy or brushy land, 9 percent is permanent pasture, and 34 percent is wooded. Slightly more than 1 percent is used for townsites, industrial sites, cemeteries, church and school grounds, and other nonfarm purposes.

Gilpin channery loam, 0 to 5 percent slopes (Ga).—This soil occurs in fairly small areas, mostly on ridges and hilltops where fairly hard parent rock and reasonably rapid geologic erosion have prevented formation of a soil as deep and well developed as the Rayne silt loams. The depth to shattered, partly weathered bedrock is normally about 24 inches. Erosion is slight to moderate.

Conservation practices: Needs erosion control where slopes are long. In many places it needs contour tillage and a good plant cover to hold water until it can sink into the soil.

Capability: Well suited to the general farm crops. Capability unit I–1.

Gilpin channery loam, 5 to 12 percent slopes (Gb).—This soil is on ridgetops and moderate slopes, including benches on steep hillsides. Erosion is generally moderate.

Conservation practices: Needs contour farming, including stripcropping, to prevent erosion and to make the most effective use of available rainfall. On long slopes there is an additional need for diversion of surface water to reduce erosion. Rotations should provide sufficient close-growing cover to make stripcropping effective.

Capability: Class II because of risk of erosion and moderate depth. Suitable for all the general farm crops of the area, including potatoes. Capability unit IIe–1.

Gilpin channery loam, 12 to 25 percent slopes (Gc).—This soil contains coarse sandstone and shale fragments up to 6 to 8 inches long and 1 to 2 inches thick. These fragments make up from 15 to 30 percent of the whole soil. Included with this soil on the map are some areas where the coarse soil fragments are much less numerous. These areas are similar to the rest of the soil in all other respects.

This soil is permeable to water, air, and roots. Roots of trees and perennial crops penetrate the cracks in the underlying sandstone and shale. The soil is naturally acid and moderately low in plant nutrients. It is friable and easily tilled except for the presence of the sandstone and shale fragments throughout the soil.

Profile in a wooded area:

0 to 2 inches, very dark grayish-brown channery loam; very weak, fine granular structure; friable; has a cover of leaf litter and a mat of well-rotted hardwood leaves that contains many tree roots.

2 to 7 inches, dark yellowish-brown channery loam; weak easily broken fine granular structure that shows platiness in place.

7 to 20 inches, yellowish-brown heavy channery loam; contains more clay and silt than horizon above; very weak medium subangular blocky structure with abundant pore spaces.

20 inches +, broken sandstone and shale fragments; some loamy soil extending down cracks to depths of 3 to 5 feet; in most places the total volume of soil, in proportion to stone fragments, is less than 10 percent.

In cultivated areas the surface 7 or 8 inches are mixed together and are a dark grayish-brown channery loam. Erosion is moderate in most cleared areas, but slight or none in forested areas.

Conservation practices: Needs careful conservation of moisture and erosion control. Contour operations, including stripcropping and a surface cover of close-growing crops most of the time, are important where the soil is cropped. Pastures should be limed and fertilized, and grazing regulated to maintain a good sod. Wooded areas need protection from grazing. Harvesting of wooded areas should be planned to avoid starting erosion in skid trails or logging roads.

Capability: Class III because of erosion hazard and shallowness. Well suited to hay and small-grain crops and to occasional use for row crops. Capability unit IIIe–1.

Gilpin channery loam, 12 to 25 percent slopes, severely eroded (Gd).—Nearly all of this soil has been cultivated, and it has lost, all or nearly all, of the original surface soil. The 5- or 6-inch plow layer generally has a concentration of coarse fragments. In places the fragments entirely cover the surface. The average depth to the partly weathered shale and sandstone bedrock is about 16 inches. The soil is somewhat droughty. Some spots are so eroded that cultivation is no longer practical.

Capability: Class III for most of the soil because of proven erosion hazard and shallowness. Areas not suitable for cultivation should be kept in permanent pasture or reforested. Capability unit IIIe–1.

Gilpin channery silt loam, 0 to 5 percent slopes (Ge).—This soil is similar to the Gilpin channery silt loam, 12 to 25 percent slopes, except that it averages a little deeper to bedrock. The depth, however, exceeds 30 inches in only a few places. The soil occurs on ridgetops and hillside benches. Erosion is mostly moderate in cleared areas, but there is severe sheet erosion in a few areas.

Conservation practices: Needs careful conservation of moisture by contour tillage, which will also reduce erosion.

Capability: Class I except for areas that have demonstrated erosion hazard, which are in Class II. Well suited to general farm crops, including potatoes. Capability unit I–1.

Gilpin channery silt loam, 5 to 12 percent slopes (Gf).—This soil occurs on moderate slopes of rounded ridges and on long moderately sloping hillsides. It is similar to Gilpin channery silt loam, 12 to 25 percent slopes, but is an inch or two deeper to partly weathered bedrock. In wooded areas, erosion is mostly slight or none, and in cleared areas it is generally moderate.

Conservation practices: Where cultivated, this soil needs water conservation and erosion control through contour stripcropping. Additional protection by diversion of surface runoff from long slopes to safe channels is often needed. Lime and fertilizer needs should be met to provide a good, vigorous plant cover.

Capability: Class II because of risk of erosion. Well suited to the general farm crops of the area, including potatoes. In many seasons production is somewhat limited by the low moisture-supplying capacity of the soil. Capability unit IIe–1.

Gilpin channery silt loam, 12 to 25 percent slopes (Gg).—This soil occurs on moderately steep hillsides. It is most common in the southern half of the county. Throughout its profile there are many fragments of sandstone and hard shale up to 6 or 8 inches in length and 1 or 2 inches thick. These fragments make up 15 to 25 percent of the upper 24 inches of the soil and as much as 90 percent of the deeper horizons. This soil is only moderately deep, and its moisture-supplying capacity is moderately low. The entire soil is friable and open, and it has good permeability and aeration. The soil is naturally acid and moderately low to moderate in content of plant nutrients.

Following is a profile:

0 to 8 inches, very dark gray or dark grayish-brown (moist) to gray or light brownish-gray (dry) channery silt loam; weak, easily crushed, fine granular structure; numerous coarse fragments of sandstone and shale, with the friable silt loam in the spaces among them.

8 to 10 inches, yellowish-brown channery silt loam; weak fine platy structure mingled with medium granular structure.

10 to 24 inches, yellowish-brown channery silt loam; contains slightly more clay than layer above; weakly developed medium subangular blocky structure; abundant pore space.

24 inches +, partly weathered shale and sandstone bedrock; some silt loam soil material in cracks to depths of 3 to 5 feet; clay coating on rocks to greater depth; roots of trees and perennial crops follow cracks to considerable depths.

Erosion is moderate in most cleared areas, but slight or none in wooded areas. Some farm woodlots have been grazed and show some sheet erosion. Other woodland shows erosion, mostly on skid trails and logging roads.

Conservation practices: In cultivated areas, needs contour stripcropping and contour cultivation to hold water where it falls until the soil can absorb it. On long slopes the surface water should be diverted to safe channels. Pastures need lime and fertilizer and grazing management to keep the sod thick at all times. Woodland needs protection from grazing and fire. Harvesting operations should be carefully planned so that the skid trails and logging roads will not start erosion.

Capability: Class III because of risk of erosion and moderately low moisture-supplying capacity. Suitable for a wide variety of general farm crops but should not be used for row crops more than one-third of the time. Capability unit IIIe–1.

Gilpin channery silt loam, 12 to 25 percent slopes, severely eroded (Gh).—This soil is similar to the less eroded phase except that it has lost all, or nearly all, of the original topsoil. The remaining plow layer has a somewhat lighter color and also has some accumulation of sandstone and shale fragments. These fragments are so numerous in many places that they form an erosion pavement, which checks erosion except where cultivation brings fine material to the surface. Erosion is severe.

Management needs: Similar to those for Gilpin channery silt loam, 12 to 25 percent slopes; also needs special care and rebuilding because of more severe erosion. Organic matter should be built up by use of grasses for a greater part of the rotation.

Capability: Class III except where gullies have become so prominent that cultivation is impractical. Permanent vegetation is a good use for this soil where cultivation is impractical. Some of this soil has been reforested, and some is being used for Christmas-tree production. Capability unit IIIe–1.

Gilpin shaly silt loam, 0 to 5 percent slopes (Gk).—This soil is similar to Gilpin shaly silt loam, 12 to 25 percent slopes. On the average it is a few inches deeper; the range in depth is from 10 to 30 inches. The soil occurs on gentle slopes on smooth ridgetops or on benches around hills. Included on the soil map are a few severely eroded spots where the soil is very shallow, but erosion generally is moderate or slight. The water-supplying capacity is low except in spots where the soil is deeper than average.

Conservation practices: Needs careful conservation of water, which often can be accomplished by contour tillage and by maintaining a rough soil surface.

Capability: Class II because of shallowness and moderate erosion hazard on many of the areas. The soil is only moderately well suited to general crops but can be used for any of the common crops of the area. Crops are frequently limited by drought. Capability unit IIe–4.

Gilpin shaly silt loam, 5 to 12 percent slopes (Gl).—This soil is similar to Gilpin shaly silt loam, 12 to 25 percent slopes, but slightly deeper. It is quite variable in depth within short distances because of differences in hardness of rock and rate of weathering. The soil is low in moisture-supplying capacity. Erosion is moderate in nearly all cleared areas and in some of the wooded areas.

Conservation practices: Needs careful water control to prevent erosion and to conserve as much rainfall as possible for use where it falls. Contour stripcropping, diversion of excess surface water to safe channels, and keeping as much of the crop residue as possible in the soil will help to prevent erosion and to conserve rainfall.

Capability: Class II because of risk of erosion and low moisture-supplying capacity. Only fairly well suited to the general farm crops of the area. Any of them can be grown, but in many seasons they are subject to damage by drought. Capability unit IIe–4.

Gilpin shaly silt loam, 5 to 12 percent slopes, severely eroded (Gm).—This soil is like the less eroded phase except that it has lost nearly all the original surface soil and is much shallower. It ranges from 8 to 16 inches in depth. Some areas that were originally silt loam are included with this soil because shale chips have accumulated in the surface soil as the finer soil material was removed. Erosion is severe.

Conservation practices: Needs careful conservation of moisture by contour stripcropping. Also needs diversion of excess surface water. Because the soil has low moisture-supplying capacity, crops that make their growth before the driest part of the season and drought-resistant grasses and legumes should be favored in the rotation.

Capability: Class III because of severe erosion hazard and low moisture-supplying capacity. Suited to many of the general farm crops, but yields are normally low in most seasons. Capability unit IIIe–1.

Gilpin shaly silt loam, 12 to 25 percent slopes (Gn).—This entire soil is moderately acid and moderately low in plant nutrients. Because it is shallow, it has a low water-supplying capacity. Even moderate rainfall exceeds the absorptive capacity of the soil, unless the water is held on the surface long enough to allow it to penetrate the underlying shale and sandstones.

Profile of a cleared area:

0 to 6 inches, very dark gray (moist) to gray (dry) shaly silt loam interspersed among shale fragments; weak, easily crushed, fine granular structure; friable when moist; thin moderately hard shale fragments, ⅛ to ¾ inches thick and 1 to 3 inches long and ½ to 2 inches wide, normally make up 20 to 30 percent of this layer.

6 to 15 inches, brown or yellowish-brown shaly silt loam; weak fine irregular blocky structure; considerable pore space; platy structure near the shale chips; friable; soil between shale fragments contains slightly more clay than surface soil.

15 inches +, gray, dark-gray, yellow, or olive partially weathered shale; some yellowish-brown soil material coats the shale chips and fills some of the cracks; black iron and manganese staining on some of the shale chips, and reddish-brown coatings on the weathered surfaces of some of the others; bottom of layer at depths of 24 to 60 inches.

Because of high runoff on moderately steep slopes, the risk of erosion is great. Erosion is moderate to severe in most cleared areas and moderate in some wooded areas. Most of the slightly eroded areas have a little deeper profile than that described.

Conservation practices: Needs contour stripcropping and contour cultivation to hold water where it falls until it can soak into the soil. On long slopes it also needs intercepting drains that will carry surface water away before it reaches this soil. Frequent moderate applications of fertilizer are needed, and need for lime should be checked at short intervals. Pasture frequently needs to be limed and fertilized and seeded with drought-tolerant grasses and legumes.

Capability: Class III because of risk of erosion and low water-supplying capacity. Only suited to crops that are tolerant of drought or that mature before the driest season of the year. Yields are generally small because of the drought hazard and the low capacity of the soil for holding plant nutrients. Forest growth is slow. This makes the soil good for Christmas-tree production, because slow growth favors development of a close-limbed, bushy tree. Capability unit IIIe–1.

Gilpin shaly silt loam, 12 to 25 percent slopes, severely eroded (Go).—This soil has lost all, or nearly all, of its original surface soil. It is very shallow. The average depth to shale and sandstone is between 10 and 12 inches. Many areas now have only a shaly thin, plow layer over the thin-bedded shale. Included with this soil are a few spots of silt loam that have fewer shale fragments but are equally shallow to bedrock. Most of the surface soil has been lost through erosion.

Conservation practices: This soil is too shallow for high production of crops. If cropped, it needs intensive care to conserve moisture and to provide plant nutrients. Crops that can withstand dry periods should be used. If the soil is used for pasture, it should be limed and fertilized and seeded with drought-tolerant grasses and legumes.

Capability: Class VI because of erosion hazard and low moisture-supplying capacity. The slow growth of trees on this soil makes it good for Christmas-tree production, because slow growth favors development of a close-limbed, bushy tree. Capability unit VIe–1.

Gilpin silt loam, 0 to 5 percent slopes (Gp).—This soil is similar to Gilpin silt loam, 12 to 25 percent slopes, but slightly deeper. It occupies flats or gently sloping areas on the ridgetops. Most of this soil is slightly sloping and has had moderate erosion under cultivation. A few areas have been severely eroded by a concentration of water.

Conservation practices: Contour tillage and, in some places, stripcropping are needed to hold water until it can soak into the soil. The moisture-supplying capacity is moderate to moderately low but is better than for other Gilpin soils.

Capability: Class II for most of this soil because of moderate depth and moderate erosion hazard. A few nearly level areas with little erosion are in class I. Suitable for all the general crops of the area, including potatoes. Capability unit IIe–1.

Gilpin silt loam, 5 to 12 percent slopes (Gr).—This soil is similar to Gilpin silt loam, 12 to 25 percent slopes, but slightly deeper. It occupies moderate slopes on the rounded hilltops and broad smooth ridges. Its water-supplying capacity is moderate to moderately low. Erosion is moderate in most cleared areas. It is slight or none in all wooded areas except some of the heavily grazed farm woodlots.

Conservation practices: In cultivated areas, needs erosion control and conservation of all water that falls on it. Contour cultivation, including contour stripcropping, is effective. On long slopes excess surface water should be diverted.

Capability: Class II because of moderate erosion hazard. Well suited to all general farm crops of the area, especially potatoes. Capability unit IIe–1.

Gilpin silt loam, 12 to 25 percent slopes (Gs).—This soil occurs on the moderate to moderately steep slopes of hills, mostly in the southern part of the county. Scattered throughout the surface soil and on the surface in most places are some shale and sandstone fragments, but they are not so numerous as in the channery or shaly Gilpin soils. This soil and the two Gilpin silt loams with slopes from 0 to 5 percent and from 5 to 12 percent, respectively, have the deepest and best-developed soil profiles in the Gilpin series. They are deep enough to provide a good rooting zone for most plants. In desirable characteristics these soils stand between the rest of the Gilpin soils and the Rayne silt loams.

Gilpin silt loam, 12 to 25 percent slopes, is porous and permeable to water, air, and plant roots. It has a moderate to moderately low water-supplying capacity. It is acid throughout and is moderately low in plant nutrients, but it has a good capacity to hold nutrients available to plant roots. The response to lime and fertilizer is therefore very good. This soil is friable and easily tilled.

Profile of plowed area:

0 to 7 inches, dark grayish-brown crumbly silt loam; weak fine granular structure.
7 to 24 inches, yellowish-brown heavy silt loam; weak fine to medium subangular blocky structure; amount of shale and sandstone fragments increases with depth.
24 inches +, broken, partly weathered shale and sandstone; yellowish-brown silt loam coatings on stone fragments; brownish-yellow to yellowish-red coatings on the shale fragments, and black iron and manganese coatings in some places; shale ranges from olive to brown or dark gray; includes some coal fragments and carbonaceous shale; bottom of layer is at depths of 30 to 60 inches, and the top at depths of 18 to 32 inches.

Wooded areas that have been protected from erosion have a slightly deeper profile. The surface is covered with a leaf litter, below which there is a mat of leaf mold containing many fine tree roots. Underneath this is the first 2 inches of mineral soil, a very dark grayish-brown silt loam of fine granular structure. From 2 to 7 inches there is light yellowish-brown silt loam of weak poorly developed platy structure that readily breaks down to weak fine granular. Erosion is moderate in most cleared areas and in some wooded areas.

Conservation practices: Needs contour cultivation, including contour stripcropping, to hold as much water as possible where it falls. To avoid serious erosion, cultivated row crops should not be grown more than 1 year in 3. Excess water should be diverted from long slopes. Lime and fertilizer to maintain high fertility and a rotation that maintains organic matter in the surface soil are needed for long-time operations on this soil. Where used for pasture, the fertility of the soil should be kept up and grazing regulated so that a good sod cover is maintained. Wooded areas should be protected from grazing, which destroys undergrowth and damages the rooting zone near the surface. Harvesting of timber should be planned to prevent erosion from starting in skid trails and logging roads.

Capability: Class III because of risk of erosion. Well suited to all general farm crops of the area; fairly good for forest. Capability unit IIIe–1.

Gilpin stony silt loam, 0 to 25 percent slopes (Gt).—This soil has many sandstone and hard siltstone boulders on the surface and throughout the profile. These boulders, 8 to 30 inches in diameter, are numerous enough to make cultivation impractical. Slopes range from level to moderately steep, but about 77 percent of this soil is on moderately steep slopes.

Nearly all of this soil has remained in woods, so that typically there is a thick cover of leaf litter underlain by a mat of leaf mold. Beneath the mat there is 2 or 3 inches of soil stained very dark grayish brown by organic matter. From a depth of 2 or 3 inches down to 7 or 8 inches, there is brownish-yellow silt loam or loam of weak platy structure. In most areas, erosion is none or only slight. Less than 10 percent of the total area shows moderate erosion.

Capability: Class VII because of stoniness. Moderately good for forest. About 93 percent of this soil has remained in forest. Cropped areas are small and

are farmed along with other soils. Capability unit VIIe–1.

Gilpin stony silt loam, 25 to 60 percent slopes (Gu).—This soil has many sandstone boulders 8 to 30 inches in diameter on the surface. Also, there are a few outcrops of sandstone or siltstone bedrock. Slopes range from steep to very steep, but about one-third of the total area has very steep slopes. This soil occurs mostly on steep valley walls near streams in the southern part of the county. Erosion is slight or none in nearly all areas.

Capability: Class VII because of stoniness, steepness, and shallowness. This soil is unsuitable for cultivation because of boulders and outcrops of bedrock. It is best suited to trees. About 95 percent has remained in forest. Capability unit VIIe–1.

Gilpin soils, 25 to 35 percent slopes (Gv).—These soils occur on steep slopes, which in many places are irregular and broken. They are friable and porous throughout and have a low water-supplying capacity. They are acid and low in plant nutrients.

Profile in a wooded area:

0 to 1 inch, very dark grayish-brown channery or shaly silt loam; this mineral soil material has a cover of hardwood leaf litter under which there is a mat of leaf mold and fine tree roots.
1 to 8 inches, dark yellowish-brown channery or shaly silt loam; weak fine granular structure; faint platiness in some places.
8 to 15 inches, light yellowish-brown channery or shaly silt loam; slightly more clay than in horizon above.
15 inches +, broken sandstone and shale fragments; some yellowish-brown soil in cracks; amount of soil material decreases with depth.

Where cultivated, the top 5 to 6 inches of the surface soil has been mixed to form a plow layer of dark grayish-brown channery or shaly silt loam. Erosion is moderate on most of the acreage, including some of the grazed or heavily cut wooded areas.

Conservation practices: These soils need the protection of good plant cover. Forested areas ordinarily should remain in that use, and they should be protected from fire and grazing. Cleared areas need the cover of good grass and legume sods. Hay and pasture plants tolerant of drought are needed. These soils should be cultivated only to reseed hay or pasture. Grazing should be limited to maintain a good sod. Lime and fertilizer needs should be checked and high fertility maintained.

Capability: Class IV because of risk of erosion and low moisture-supplying capacity. These soils are best suited to trees. More than half the acreage is forested. These soils are only fair for hay and pasture. Production is likely to be low in most seasons. Capability unit IVe–1.

Gilpin soils, 25 to 35 percent slopes, severely eroded (Gw).—These soils are similar to Gilpin soils, 25 to 35 percent slopes, except for having lost much of the original surface soil and in being shallower to weathered bedrock. The depth to bedded shale or sandstone ranges from 6 to 20 inches but on the average is between 10 and 12 inches. Shale chips or small fragments of sandstone normally litter the surface. In some places the fragments form an erosion pavement that checks further erosion until the soil is cultivated.

These soils have a low moisture-supplying capacity and are low in natural fertility. Erosion is severe.

Conservation practices: If these soils are used for pasture, drought-tolerant grasses and legumes should be introduced and the fertility built up. The productivity of cleared areas can be restored gradually by planting timber species or Christmas trees.

Capability: Class VI because of serious erosion hazard and low water supply. Only fair for trees. On the extensive idle areas the vegetation is mainly povertygrass *(Danthonia spicata)*, broomsedge *(Andropogon virginicus)*, blackberry, dewberry, and some seedling trees. Pastures consist mostly of poor grasses that are low in productivity. Capability unit VIe–1.

Gilpin soils, 35 to 60 percent slopes (Gx).—These are the steepest of all the Gilpin soils that have developed on the typical parent materials. They are similar to Gilpin soils, 25 to 35 percent slopes, but shallower. They occur on such steep slopes that some downhill creep of the soil material is noticeable. In many of the wooded areas tree trunks have bent to maintain vertical growth because soil creep has tipped the roots downslope. These soils have a low moisture supply. Erosion is moderate in most cleared areas and in many of the wooded areas where grazing or fire after logging have exposed the soil.

Conservation practices: Needs the protection of forest cover. Slopes are too steep for effective management of pasture.

Capability: Class VII because of great erosion hazard, steepness, and low moisture-supplying capacity. Forest productivity is only moderate because of low moisture supply. More than three-fourths of total acreage is wooded. Capability unit VIIe–1.

Gilpin soils, 35 to 60 percent slopes, severely eroded (Gy).—These soils are similar to the Gilpin soils, 35 to 60 percent slopes. They have lost much of the original surface soil through accelerated erosion. They are shallower than the less eroded Gilpin soils on 35 to 60 percent slopes and are frequently littered with shale chips and small bits of sandstone. Erosion is severe.

Conservation practices: Reforestation of the cleared areas either for timber or Christmas trees is a means of gradually restoring these soils to productivity.

Capability: Class VII because of serious erosion, steepness, and low available moisture-supplying capacity. Only moderately well suited to forest production. In idle areas and many pastures the vegetation consists of povertygrass and broomsedge, and some of the ground is bare. In typical pastures and idle areas, blackberries, dewberries, and seedlings of many shrubs and trees are starting. Capability unit VIIe–1.

Ginat Series

Ginat silt loam, 0 to 5 percent slopes (Gz).—This is the only soil mapped in the Ginat series in Clarion County. It is the poorly drained soil that developed on old terraces of alluvial sand, silt, and gravel. It occurs on flats at elevations between 1,100 and 1,200 feet in the vicinity of Callensburg and Foxburg. It is 200 to 300 feet above the level of the present streams. This soil is associated with the well-drained Wheeling and the moderately well drained Sciotoville soils. Included with this mapping unit are a few very poorly drained areas that are too small to map separately. If these included areas were mapped separately, they would be Chilo silt loam.

The total area of the Ginat soil is about half a square mile. About 60 percent is cropped, 2 percent is idle, 30 percent is in permanent pasture, and 8 percent is wooded.

The Ginat silt loam, 0 to 5 percent slopes, contains very few pebbles or coarse rock fragments. It is level to gently sloping; about 90 percent of the acreage is on slopes of less than 2 percent. The entire soil is moderately acid.

Following is a profile of this soil:

0 to 8 inches, dark grayish-brown (moist) to gray (dry) silt loam; weak fine granular structure; friable.
8 to 12 inches, faintly mottled yellowish-brown, pale-brown, and gray heavy silt loam; moderately well developed medium, subangular blocky structure; considerable pore space; friable when moist.
12 to 30 inches, strongly mottled brown and gray heavy silt loam; strong medium blocky structure; angular, well-formed blocks stacked one on top of another in prisms; blocks are uniformly coated with gray silt and dense and firm in place; slightly plastic when wet.
30 to 60 inches, mottled gray, yellowish-brown, and strong-brown silty clay loam; strongly developed coarse blocky structure; blocks arranged in prisms; firm in place and slightly plastic when wet.
60 inches +, alternate layers of sand and gravel or, in some places, sandstone or shale bedrock.

Erosion is slight or none on most areas, or there has been slight deposition. On more than one-fourth of the acreage erosion has been moderate because of the movement of large volumes of surface water across the easily dispersed and transported silt loam.

Conservation practices: The soil is dense and only slowly permeable below the upper 12 inches. Aeration is poor, and the soil remains waterlogged for long periods. The soil is too poorly drained for most crop plants to thrive. Drainage can be improved to some extent by open drains or by tile, but the soil will still have limited suitability for cropping. The subsoil is so slowly permeable that drawdown by either tile or open ditches is very slow. Because this soil occupies depressed areas in the terraces, it normally receives runoff from higher terrace soils and from the upland. The digging of intercepting drains that will carry the water away before it reaches this soil is a first step in improving drainage. For cultivation or for improved pastures, some degree of artificial drainage is necessary. Otherwise, seedings will be delayed, crops will be lost, and pastures will be ruined by trampling.

Capability: Class III because of poor drainage. Fairly well suited to spring grains, corn, and hay. Hay or pasture seedings should consist mostly of grasses and legumes that are tolerant of wet conditions. Capability unit IIIw–1.

Gravel Pits

This miscellaneous land type consists of areas where the soil has been destroyed by the removal of gravel or shale for use in construction, road surfacing, and so on. There are no large areas in the county. In some places enough soil material is scattered in the pit to reestablish vegetation. In other areas everything was removed down to hard rock. In all cases, there is a steep wall at the edge of the pit where slumping can be expected and stabilization will be slow.

This unit is in land capability class VIII. Areas of this land type are indicated by standard symbol. Capability unit VIIIs–1.

Gravelly Terraces

Two units of gravelly terraces are mapped in Clarion County, one on slopes of 12 to 25 percent, and the other on slopes of 25 to 45 percent. Both are on the steep edges of terraces and associated hummocky areas where soil development has not been sufficient to form soils of the Wheeling or Sciotoville series. These weakly developed soils on these terraces are deep and well drained and contain an abundance of gravel throughout. They occur 150 to 300 feet above the present streams. The parent material is coarse alluvial wash that apparently has been transported by rivers that flowed at much higher levels than the levels of the present Allegheny and Clarion Rivers.

The native vegetation was mixed hardwoods with some white pines.

The two mapping units cover a total area of less than 1 square mile. About two-fifths of the total acreage is cropped, and one-fourth is idle.

Gravelly terraces, 12 to 25 percent slopes (Gla).—The slopes of this land type are moderately steep but mostly short. The land has been used fairly intensively. The entire soil is naturally acid.

Following is a profile:

0 to 7 inches, dark grayish-brown gravelly loam or gravelly sandy loam; very loose and porous.
7 to 30 inches, strong-brown gravelly loam; very weak subangular blocky structure between the pebbles; friable and porous.
30 inches +, dark yellowish-brown gravelly sandy loam; some dark coatings on the gravel.

The gravelly material has resisted erosion. Moderate erosion on most of the area has removed the fine material. Concentrated sheet erosion has caused severe erosion and gullying on about 50 acres.

Conservation practices: Needs the protection of close-growing crops during most of the rotation. Deep-rooted crops are well suited. The soil is droughty for shallow-rooted crops because of the low water supply.

Capability: Class III because of erosion hazard and low water-supplying capacity. Moderately well suited to alfalfa and other deep-rooted crops. Capability unit IIIe–1.

Gravelly terraces, 25 to 45 percent slopes (Glb)—This land type is similar to Gravelly terraces, 12 to 25 percent slopes, but shallower to loose sand and gravel. Erosion is about the same as for Gravelly terraces, 12 to 25 percent slopes.

Capability: Class IV because of steepness of slope and low water supply. Fairly well suited to alfalfa. Some of the steepest areas are only suitable for trees. Capability unit IVe–1.

Holston Series

In the Holston series are well-drained soils that developed from acid silty deposits on old alluvial plains. The deposits have been undisturbed long enough to allow normal maturing of the soil profiles. The soils are associated with moderately well drained Monongahela soils.

The native vegetation was mixed hardwoods, with oaks predominating. White, red, scarlet, and chestnut oaks, as well as tulip-poplar, black cherry, and red maple, are common trees. Many other hardwoods, including basswood, sassafras, cucumbertree (magnolia), ash, elm, walnut, and butternut, are scattered in the remaining woods.

The Holston soils all have a moderately high moisture-supplying capacity. They are acid and rather thoroughly leached of plant nutrients.

The total extent of the Holston soils in Clarion County is about 1 4/5 square miles. Of this area, about one-third is cropped and one-third is in townsites and in other nonfarm use. The location of these soils on gentle to moderate slopes near streams but above the flood level accounts for the high proportion of the total acreage in townsites.

Holston silt loam, 0 to 2 percent slopes (Ha)—This soil has a profile similar to Holston silt loam, 2 to 8 percent slopes, the soil next described. Erosion is slight.

Capability: Class I. Well suited to all general farm crops of the area if lime and fertilizer needs are met. Capability unit I–1.

Holston silt loam, 2 to 8 percent slopes (Hb).—This soil occurs on gentle to moderate slopes, mostly about 3 percent. It is acid throughout and is moderately low in plant nutrients. The moisture-supplying capacity is moderately high.

Following is a typical profile:

0 to 8 inches, dark grayish-brown silt loam of weak fine granular structure; friable; easily tilled.
8 to 10 inches, light yellowish-brown silt loam; weak fine platy structure.
10 to 36 inches, strong-brown to yellowish-red silty clay loam; moderately well developed medium subangular blocky structure; moderate pore space between blocks; permeable to water, air, and plant roots.
36 to 48 inches, yellowish-brown silty clay loam faintly mottled with gray; moderately coarse blocky structure; firm in place; in some places horizon contains considerable gravel and streaks or pockets of sand.

Sandstone and shale bedrock begins at depths ranging from 48 to 240 inches.

Some areas of this soil near Hawthorn and New Bethlehem are coarser in texture and have a loamy or fine sandy loam surface soil and a silt loam or heavy loam subsoil. Some other areas near Climax, southwest of New Bethlehem, have a darker brown surface layer. These are at elevations of 100 feet above Redbank Creek. Erosion is moderate in most areas. About one-fourth of the total area has no recognizable erosion.

Conservation practices: Needs contour farming and attention to maintaining organic matter by crop rotations and by return of crop residues.

Capability: Class II because of moderate erosion hazard. Well suited to all general farm crops of the area. Where not used for townsites, the acreage generally is in crop production. Capability unit IIe–1.

Holston silt loam, 8 to 15 percent slopes (Hc).—This soil occurs on broken moderately sloping parts of old stream terraces. Included are a few acres of moderately steep broken terrace edges where slopes exceed 15 percent. Erosion is generally moderate, and in wooded areas, slight or none.

Conservation practices: Where farmed, needs thorough erosion control and measures to build up fertility. Contour stripcropping and a rotation that provides grass cover at least 2 years out of 4 are suitable.

Capability: Class III because of risk of erosion. Well suited to all general farm crops of the county. Capability unit IIIe–1.

Leetonia Series

The Leetonia series consists of well-drained upland soils that developed on coarse sandstone. These soils occur in the eastern edge of the county in Cook Forest and northward. They are associated with Dekalb channery sandy loam and Dekalb stony loam.

Both of the two Leetonia soils mapped in Clarion County are stony and contain sandstone fragments from ½ inch to 4 feet in diameter that make up from one-fourth to one-half of the soil bulk. Some less stony areas that developed from similar material have lost most of the characteristic surface features of Leetonia soils and have been included in Dekalb channery sandy loam.

The native vegetation is hemlock and white pine, with only scattered hardwoods. There are very few shrubs. Ferns and moss provide the only ground cover on most of the acreage.

The total area of the Leetonia soils is more than 6 square miles. About 99 percent is wooded and includes part of Cook Forest State Park.

Leetonia stony sandy loam, 0 to 25 percent slopes (La).—This soil is permeable throughout. It is acid and thoroughly leached of plant nutrients.

Profile in a wooded area:

0 to 5 inches, dark-gray light stony sandy loam, loose and structureless, between sandstone fragments that make up 25 to 70 percent of the layer; horizon varies from 2 to 7 inches in thickness.

Under the 0 to 5 inch layer just described are pockets of yellowish-brown to brown stony sandy loam that form a discontinuous layer that ranges up to 6 inches thick. Above the 0 to 5 inch layer is about 1 inch of dark-brown pine and hemlock needles and twigs and 1 inch of black well-rotted needles tied together with fungus mycelia and many fine tree roots.

5 to 30 inches, yellowish-brown, structureless stony sandy loam between sandstone fragments that make up 50 to 75 percent of the layer.

30 inches +, sandstone; some soil in cracks; depth of soil to sandstone ranges up to 96 inches.

Capability: Class VII because of stoniness. Moderately well suited to the growth of coniferous forests. Fertility is too low for good production of hardwoods. More than 98 percent of the total area is in forest. Capability unit VIIe–2.

Leetonia stony sandy loam, 25 to 60 percent slopes (Lb).—This soil is similar to Leetonia stony sandy loam, 0 to 25 percent slopes. The dark-gray layer on top of the mineral soil normally is shallower and is missing in some spots. The surface commonly is rough and irregular.

Capability: Class VII because of stoniness and steepness. The soil is fair for hemlock and white pine but is poor for hardwoods. Practically all of it is wooded. Capability unit VIIe–2.

Lickdale Series

The Lickdale series consists of upland or colluvial soils that developed from parent materials derived from acid sandstone and shale. They occur throughout the county in depressions where water concentrates but where definite stream channels for drainage have not developed. They are associated with nearly all the upland soils of the county and with Ernest and Brinkerton soils on lower colluvial slopes.

Trees common in wooded areas are elm, hickory, red maple, swamp white oak, hemlock, and beech. Spicebush *(Benzoin)* and alders form a thick underbrush in many areas. Open areas are mostly covered by sedges and coarse swampgrasses of many kinds.

The texture of the Lickdale soils varies somewhat, according to the proportions of sandstone and clay shale in the parent rock. Because the water table is high and the drainage is very poor, organic matter accumulates on the surface and in the upper part of the soils. These soils remain waterlogged much of the time. They are too wet for cultivation or for good pasture production without artificial drainage. Tree growth also is limited by the general wetness of the soils. Some trees that thrive only on better drained soils have become established on hummocks that rise above the general surface level.

Lickdale soils have a total area of more than 8 square miles. More than half is in trees, and more than one-fifth is in permanent pasture. The rest is idle or in crops.

Lickdale silt loam, 0 to 2 percent slopes (Lc).—This nearly level soil occurs in low places. It is acid throughout but is generally fairly well supplied with plant nutrients because it is not greatly leached and receives drainage from higher areas. The subsoil is slowly permeable and is difficult to drain. Following is a profile:

0 to 6 inches, black silt loam; moderately stable medium granular structure; friable; this layer commonly covered by about 2 inches of black well-rotted leaves, grasses, and twigs tied together by roots of trees, grasses, or sedges.

6 to 8 inches, commonly gray silt loam slightly mottled with brown; moderately well developed medium platy structure; slightly plastic when wet; under cultivation or heavy grazing, this layer often lost by mixing with above layer.

8 to 30 inches, mottled dark-gray and strong-brown silt loam to silty clay loam; strongly developed coarse blocky structure; plastic when wet and hard when dry.

30 inches +, dark-gray silt loam to silty clay loam; strong coarse blocky structure that becomes less distinct below 40 inches.

The texture of these lower horizons varies according to the texture of the associated soils. Where it is associated with Cavode and Armagh soils, its subsoil is normally silty clay. Near a Dekalb soil, the subsoil is silt loam or silty clay loam, and near Gilpin and Ernest soils, the subsoil is normally silty clay loam.

There is generally no erosion, but the range is from slight sheet erosion to moderate deposition of eroded materials. Areas that have not been cultivated are hummocky.

Conservation practices: Needs drainage if used for crops and pasture. Areas now cropped are mostly small low spots that interfere with efficient use of better drained land in the same field. Improving this condition requires that the field layout be changed or that the cropped area be drained. Pasture areas are usually hummocky and weedy. They need some drainage and careful management of grazing to keep the sod from being destroyed when the soil is wet. Grasses should be used that are tolerant of wet periods.

Capability: Class VI because of poor drainage. Capability unit VIw–1.

Lickdale silt loam, 2 to 10 percent slopes (Ld).—This soil is similar to Lickdale silt loam, 0 to 2 percent slopes. It occurs on gentle to moderate slopes, which are mostly only a little more than 2 percent. A few areas with 8 to 10 percent slopes are continually wet because of hillside seepage. Erosion, including some gullying, is moderate on a small part of the soil.

Capability: Class VI because of wetness. Use suitability is similar to that for Lickdale silt loam, 0 to 2 percent slopes. Needs management similar to that for Lickdale silt loam, 0 to 2 percent slopes, except that surface drainage is more easily obtained and the chances of successful drainage are better. Capability unit VIw–1.

Lickdale stony silt loam, 0 to 8 percent slopes (Le).—This soil has numerous sandstone boulders 8 to 48 inches in diameter on the surface and throughout the profile. The boulders make artificial drainage more difficult.

Capability: Class VI because of poor drainage and stoniness. About four-fifths of the total area is wooded. Capability unit VIw–1.

Made Land

This miscellaneous land type consists of areas where the normal soil profile has been covered or destroyed by artificial earth-moving operations. It occurs in areas graded and ridged for oil storage tanks or graded for railroad yards, athletic fields, or large lawns.

Conditions for plant growth are variable and uncertain, and management needs vary from area to area. This unit is in land capability class VII. Areas are indicated by standard symbol. Capability unit VIIe–2.

Mine Dumps

This miscellaneous land type includes the waste piles around the mouths of deep mines and at loading points where strip-mined coal is cleaned. The material in the waste piles consists of mixed carbonaceous shale and low-grade coal discarded in mining and coal cleaning. It generally occurs in mounds that have steep side slopes. Much of the soil material is too acid for plant growth. Where it is sufficiently leached of acid to permit growth of vegetation, trees, shrubs, vines, and grasses should be established to cover and stabilize these mounds.

This unit is in land capability class VIII. Areas are indicated by standard symbol. Capability unit VIIIs–1.

Monongahela Series

In the Monongahela series are moderately well drained silty soils on old alluvial terraces above the flood plains of present streams. They occur mostly in the southern part of the county near Redbank Creek. The soil material has remained in place long enough for a strongly expressed profile to develop. The most marked characteristic of these soils is a tight, dense, brittle layer in the lower subsoil beginning at depths of 18 to 36 inches. The Monongahela soils are associated with the well drained Holston and the heavier somewhat poorly drained Tyler soils.

The native vegetation was mixed hardwoods. White and red oaks, red maple, beech, hickory, and chestnut oak are common on these soils. Many other species of trees are scattered in what is now only the remnants of a forest.

The level and gently sloping bench positions, the freedom from stones, and the moderately high moisture-supplying capacity make the Monongahela soils desirable for agriculture. But the tight subsoil layer, which causes seasonal waterlogging, and the low natural supply of plant nutrients somewhat restrict their agricultural use.

The total extent of the Monongahela soils in the county is 3 square miles. More than two-fifths of the acreage is cropped, about one-fifth is idle, and about one-fifth is wooded.

Monongahela silt loam, 0 to 2 percent slopes (Ma).—This soil is similar to Monongahela silt loam, 2 to 8 percent slopes. It occurs on nearly level slopes where surface drainage is often slow and is hard to improve.

Conservation practices: If used for crops or pasture, needs crop or pasture plants that can survive seasonal waterlogging. Fertility should be built up and maintained by liming and fertilizing. Rotations that feature grass and the return of crop residues will help to maintain organic matter and improve tilth of the surface soil.

Capability: Class II because of only moderately good drainage. Fairly well suited to general farm crops. In many seasons seasonal wetness will damage potatoes, alfalfa, and winter grain. Capability unit IIw–1.

Monongahela silt loam, 2 to 8 percent slopes (Mb).—This soil occurs on gentle slopes. It is acid throughout, except where liming has changed the reaction of the surface soil. It is naturally low in plant nutrients.

Profile in a cultivated area:

0 to 8 inches, very dark grayish-brown (wet) to light grayish-brown (dry) silt loam; weak fine granular structure that easily breaks into single grains; friable when moist.

8 to 10 inches, light yellowish-brown silt loam; weak fine granular structure that shows some platiness; friable when moist.

10 to 19 inches, yellowish-brown, smooth fine silt loam to silty clay loam; weak, fine to medium, subangular blocky structure; porous and friable.

19 to 24 inches, yellowish-brown fine silt loam or silty clay loam faintly mottled with gray and pale-brown; moderately well developed medium and fine blocky structure.

24 to 32 inches, strongly mottled light yellowish-brown silty clay loam or fine silt loam; moderate medium platy structure; firm and dense in place when moist, and hard and brittle when dry.

32 to 42 inches, light yellowish-brown silt loam or silty clay loam mottled with brown and gray; well-formed coarse blocky structure; blocks coated with gray silt; some black iron and manganese coating; firm in place; less hard and brittle than layer above.

42 inches +, somewhat stratified beds of silt, fine sand, and clay.

In wooded areas and in old fields that have not been plowed for a long time, there is distinct medium-sized platy structure at depths of 2 to 4 inches.

Monongahela silt loam, 2 to 8 percent slopes, is slowly permeable below an average depth of 24 inches. In wet seasons the soil above this is waterlogged for fairly long periods. The moisture-supplying capacity is moderately high. Erosion is moderate in most areas.

Conservation practices: The seasonal waterlogging causes considerable surface runoff, especially early in spring. This soil needs diversion of excess surface water and cultivation on a slight grade to provide surface drainage without erosion. It needs maintenance of organic matter to preserve the structure of the surface soil and to prevent the forming of a surface crust.

Capability: Class II because of risk of erosion and only moderately good drainage. Fairly well suited to most general farm crops if the fertility level is raised. There will be some damage to potatoes, alfalfa, and winter grain because of the seasonally high water table. Capability unit IIe–6.

Monongahela silt loam, 8 to 15 percent slopes (Mc).—This soil is similar to Monongahela silt loam, 2 to 8 percent slopes, but there are more gullies. It occurs 20 to 200 feet above present streams on the moderately sloping edges of old alluvial terraces. Erosion is mostly moderate.

Management needs: Similar to those for Monongahela silt loam, 2 to 8 percent slopes, but soil needs more protection from erosion.

Capability: Class III because of risk of erosion and only moderately good drainage. Crop suitability is similar to that for Monongahela silt loam, 2 to 8 percent slopes. Capability unit IIIe–4.

Monongahela silt loam, 15 to 25 percent slopes (Md).—In drainage and parent material this soil is similar to Monongahela silt loam, 2 to 8 percent slopes. It occurs on the broken, eroded, moderately steep edges of stream terraces. Erosion is severe in most places.

Conservation practices: Needs the protection of close-growing vegetation at all times.

Capability: Class VI because of risk of erosion. Where erosion has made cultivation very difficult, a use that does not require tillage is more practical. Because it occurs in isolated strips, some of this soil is suitable for hay, some for pasture, and some for trees. Capability unit IVe–3.

Nolo Series

The Nolo series consists of poorly drained upland soils developed on weathered sandstone that contains some interbeds of shale. These soils occur mainly in the northeastern part of the county on broad flat ridgetops. They are associated with well drained Dekalb and Clymer, moderately well drained Cookport, and very poorly drained Lickdale soils.

The second-growth forests consist of mixed hardwoods and considerable white pine and hemlock. Common hardwoods on these soils are beech, red maple, black birch, and oaks.

The surface soils of the Nolo series are gray or light brownish gray. The subsoils have a tight, compact, brittle layer at depths ranging from 10 to 20 inches.

The total area of Nolo soils is less than 7 square miles. Only 10 percent is in crops, more than 30 percent is idle, and about 3 percent is in permanent pasture. The rest is wooded.

Nolo silt loam, 0 to 2 percent slopes (Na).—This soil normally has some sandstone fragments up to 6 or 8 inches in length on the surface and throughout the profile. It occurs on nearly level areas where surface drainage is slow and internal drainage is very slow. It is strongly acid and very low in plant nutrients.

Profile in a wooded area:

0 to 3 inches, light brownish-gray silt loam or heavy loam; weak, easily crushed, fine granular structure; friable and porous; layer covered by about 1 inch of leaf litter and a mat of black leaf mold that contains many fine tree roots and much fungus mycelium.
3 to 12 inches, pale-brown silt loam mottled with gray and yellow; weak fine granular structure; friable.
12 to 16 inches, light yellowish-brown heavy silt loam or silty clay loam mottled with light gray; weak fine subangular blocky structure; firm in place.
16 to 30 inches, mottled gray and yellow silt loam or silty clay loam; strong medium platy structure; dense and very firm when moist and hard and brittle when dry.
30 inches +, partly weathered broken sandstone and shale.

Erosion is slight or none in most areas.

Conservation practices: Where used for crops or pasture, needs some surface drainage and protection through diversion ditches that will carry away excess surface water and subsurface seep from higher land before it reaches this soil. Lime and fertilizer are necessary to increase the soil fertility. Wooded areas should be protected from grazing. Tree roots are concentrated in the organic surface mat and can be damaged by trampling.

Capability: Class III because of poor drainage. Not well suited to crops, but some areas have become fairly good for crops through improved drainage and increased fertility. Capability unit IIIw–1.

Nolo silt loam, 2 to 10 percent slopes (Nb).—This soil is similar to Nolo silt loam, 0 to 2 percent slopes, except that it is a little more variable in depth and texture because of local variation in hardness and texture of bedrock. Surface drainage is slightly better on areas that have been cultivated. Drainage is about the same as for Nolo silt loam, 0 to 2 percent slopes, on the uncultivated areas where the very hummocky surface prevents free surface flow.

Under cultivation, there has been some erosion. In a few spots where water has concentrated, erosion has been severe.

Conservation practices: The definite slope of this soil makes drainage and control of surface water easier than for Nolo silt loam, 0 to 2 percent slopes. Both surface flow and the flow through the soil above the tight pan in the subsoil can be controlled by intercepting drains.

Capability: Class III because of the combination of poor drainage and moderate erosion hazard. Under management practices to improve drainage and soil fertility, the soil is only moderately well suited to general farm crops. Some damage by winterkilling can be expected in wet seasons. Capability unit IIIe–6.

Nolo stony silt loam, 0 to 8 percent slopes (Nc).—This soil has numerous sandstone boulders, 8 to 48 inches in diameter, on the surface and throughout the profile. It ranges from level to moderately sloping.

Capability: Class VI because of the combination of stoniness and poor drainage. Capability unit VIw–1.

Philo Series

The Philo series is made up of moderately well drained and somewhat poorly drained soils of the flood plains. These soils occur as small strips along streams in all parts of the county. There are only two types mapped in Clarion County. The Philo fine sandy loam, 0 to 6 percent slopes, is mostly in the north-

eastern part of the county where the Dekalb and Clymer are the dominant upland soils. It occurs locally in other places where there is considerable sandstone. The Philo silt loam, 0 to 6 percent slopes, occurs along streams in areas with Gilpin and Cavode soils on the uplands. The Philo soils are associated with the well drained Pope and the poorly drained Atkins soils of the flood plains.

The Philo soils consist of alluvium washed from upland soils that are underlain predominantly by acid sandstones and shales. Philo soils are subject to flooding and in most places still receive some deposits. In a few places they are being damaged and cut down by scouring and stream erosion. Frequency of overflow varies with the height of the soil above the stream and with the rate of flow in the stream. In some places flooding is too frequent for cropping. Along other streams, floods are most likely early in spring before the growing season, and damage to summer-grown crops is rare.

The native vegetation was forest, and stands of mixed hardwoods still occupy about two-thirds of the total area. The principal trees on Philo soils are hickory, ash, black cherry, wild cherry, elm, willow, birch, sycamore, hornbeam, crabapple, and thornapple. Basswood, butternut, and oaks are also present. On the fine sandy loam there are many hemlocks. Alder, spicebush, elderberry, and blackberry make thick underbrush where there is an opening in the tree canopy.

The water table in these soils varies with stream levels but is usually at moderate depths. The fairly large amount of the total acreage in permanent pasture reflects the availability of water for stock and the good water supply during summer months, which keeps grasses growing when most upland pastures are not producing.

The total area covered by the Philo soils is 9 square miles. Only 8 percent is cropped, and 7 percent is idle. About 16 percent is used for permanent pasture, more than 67 percent is wooded, and more than 1 percent is in townsites or in miscellaneous uses.

Philo fine sandy loam, 0 to 6 percent slopes (Pa).—This soil is variable because it has formed from stream deposits that washed from soils of different characteristics. Most of it occurs on slopes of less than 2 percent, but about 5 percent of the total area is on moderately sloping fans of recent alluvium. The entire soil is friable and permeable to water. It is moderately acid.

Following is a typical profile:

0 to 10 inches, dark-brown fine sandy loam; weak platy to weak medium granular structure.
10 to 15 inches, dark-brown fine sandy loam without notable structure.
15 to 40 inches +, mottled yellowish-brown, light yellowish-brown, and gray structureless fine sandy loam.

There are many variations from this typical profile. In some places the soil is a coarser sand. Locally, gravelly spots are on the surface. Many areas are underlain by gravel and sand at depths of 2 or 3 feet. Depth to the mottling that shows the location of the poorly drained layer varies from 12 to 30 inches. In some areas this soil is strongly acid because sulfur water drains from the mines on the adjacent upland. Erosion is generally none or slight. As a whole, the deposits outweigh the loss of soil through erosion.

Capability: Class II where accessible, because of the moderately high water table and occasional flooding. These factors impose the principal restrictions on use of this soil. The somewhat high water table limits the rooting of many crop plants. Use of this soil also is hindered by its occurrence in many narrow valleys between steep slopes of nonagricultural upland soils. More than 95 percent of the total acreage is wooded. Capability unit IIw–2.

Philo silt loam, 0 to 6 percent slopes (Pb).—Most of this soil is level, but about 3 percent of it is on moderately sloping fans of recent alluvium. Individual areas on these fans are small.

This entire soil is friable and permeable to water. It is acid. Following is a typical profile:

0 to 11 inches, dark-brown silt loam; weak, easily broken, medium platy structure mixed with weak, fine to medium, somewhat subangular blocky structure.
11 to 16 inches, dark-brown or dark yellowish-brown silt loam with no apparent structure.
16 to 46 inches +, mottled yellowish-brown, light yellowish-brown, dark-brown, and gray silt loam; structureless; mottling becomes stronger with depth.

The texture of this soil varies considerably, and some loamy spots and a few small areas of silty clay loam are included with the silt loam. In places the soil is underlain by gravel and sand at depths of 3 or 4 feet. There are some areas with gravel and stone fragments on the surface. Depth to the mottling that indicates the location of the poorly drained layer varies from 12 to 30 inches. In some areas this soil is strongly acid because sulfur water drains from the adjacent upland where mining or coal stripping are extensive. In some watersheds where liming has been heavy, the natural acidity has been partly neutralized by lime washed from the uplands.

As a whole, the deposits outweigh the soil losses through erosion. Some spots show erosion caused by flooding when the soil was not covered by vegetation and was easily moved or erosion caused by diversion of strong flow from the main stream channel.

Management needs: Where cultivated, this soil needs a close-growing winter cover for protection from early spring floods. Along streams that flood frequently in midsummer, the surface should be kept smooth. Ridged cultivation concentrates flow and may cause both erosion and deposition of sandbars.

Capability: Class II because of the seasonally high water table and the risk of flooding. Capability unit IIw–2.

Pope Series

The Pope series are deep well-drained alluvial soils on flood plains of streams that drain acid soils of the uplands. These soils are located mostly along the larger streams, but some smaller areas are along many small tributary streams. The soils of the Pope series are associated with the moderately well drained to somewhat poorly drained soils of the Philo series and with the poorly drained soils of the Atkins series.

Three Pope soils are mapped in Clarion County. Pope fine sandy loam, 0 to 5 percent slopes, occurs mostly in the northeastern part of the county in association with Dekalb soils of the upland. Pope fine sandy loam, 5 to 8 percent slopes, occurs mostly along the Allegheny River in scattered fan-shaped areas of recent alluvium. Pope silt loam occurs in areas where the Gilpin and Cavode are the principal soils of the upland.

The native vegetation was mixed hardwoods. Many kinds of trees were present because seeds were carried by the water.

The soils are permeable and well aerated. Occasional flooding may cause damage to crops and to town property. Floods usually occur during seasons when most of the common crops can withstand wetness.

The total area covered by the Pope soils is less than 2 square miles. About 20 percent is cropped, 8 percent is idle, 15 percent is in permanent pasture, 38 percent is wooded, and 19 percent is used for townsites.

Pope fine sandy loam, 0 to 5 percent slopes (Pc).—This soil is friable and permeable to water, air, and roots. Following is a typical profile:

0 to 3 inches, dark grayish-brown fine sandy loam; very weak fine granular structure.
3 to 10 inches, brown fine sandy loam without well-defined structure.
10 to 40 inches +, yellowish-brown fine sandy loam, frequently underlain by stratified sand and gravel.

Included with this soil are some spots of loamy sand and some gravelly areas.

Capability: Class I. Well suited to many farm crops, but much of this soil is isolated by surrounding steep nonagricultural soils. Capability unit I–2.

Pope fine sandy loam, 5 to 8 percent slopes (Pd).—This soil is similar to Pope fine sandy loam, 0 to 5 percent slopes, except that it is somewhat more variable in texture. It mostly occurs along the Allegheny River. Some of the soil is included in the towns of Foxburg and East Brady. Deposits and soil losses through erosion are balanced in most areas.

Capability: Class II because of the moderate slope. Seventy-six percent of the total area is in townsites. Capability unit IIe–2.

Pope silt loam, 0 to 5 percent slopes (Pe).—Most of this soil is nearly level. Only areas on small local alluvial fans have slopes up to 5 percent. The whole soil is acid. It is friable and permeable to water, air, and roots.

Following is a profile:

0 to 8 inches, dark grayish-brown silt loam; weak fine granular structure.
8 to 36 inches +, brown or yellowish-brown silt loam; very weakly developed fine granular structure; normally underlain by stratified silt, sand, and gravel; in some places bedrock is at depths of 4 or 5 feet.

Deposition generally exceeds erosion.

Capability: Class I. This is a good agricultural soil but occupies only small areas. Occasional flooding occurs but seldom when the common crops are vulnerable to serious damage. Capability unit I–2.

Rayne Series

Rayne soils are deep well-drained upland soils that have developed on gray and yellow siltstone and fine sandstone. They occur on smooth gently to moderately sloping ridges and hilltops, mostly in the southern and western parts of the county. They are associated with the shallower, less well developed soils of the Gilpin series.

The native vegetation was mixed hardwoods with a few white pines. White, red, scarlet, and chestnut oaks, tulip-poplar, black cherry, red maple, dogwood, and ash are common trees on these soils.

The depth, good drainage, moderately high water-holding capacity, and gentle to moderate slopes all favor fairly intensive agricultural use of Rayne soils.

The total area is about 4 1/3 square miles. More than two-thirds is cropped, and the rest is divided as idle land, permanent pasture, woodland, and townsites.

Rayne silt loam, 0 to 5 percent slopes (Ra).—This soil has some fragments of sandstone or shale on the surface, but they seldom make up 10 percent of the surface layer. In about 3 percent of the area, sandstone fragments are numerous. The soil is acid throughout.

Profile in a cultivated area:

0 to 8 inches, very dark grayish-brown silt loam of weak, crumbly, fine granular structure; friable and easily tilled; surface appears light brownish gray when dry.
8 to 10 inches, light yellowish-brown silt loam of weak fine granular structure.
10 to 24 inches, yellowish-brown silty clay loam; weak, fine, subangular blocky structure; friable and porous.
24 to 36 inches, light yellowish-brown silty clay loam; moderate medium blocky or somewhat subangular blocky structure; somewhat firm in places and slightly plastic when wet; porous and permeable.
36 inches +, partially weathered sandstone and shale.

In wooded areas the surface is covered with hardwood leaf litter, below which there is about ¾ inch of black leaf mold. The leaf mold is somewhat mixed with the mineral soil and usually contains worm casts and other signs of insect work. From the bottom of the leaf mold to a depth of 3 inches the silt loam soil is dark grayish brown and shows some platy structure mingled with fine granular.

Erosion is slight on much of the soil and moderate on some. Only a few small spots show severe erosion.

Conservation practices: This soil is nearly level to gently sloping. Most of it needs contour cultivation to hold water where it falls.

Capability: Class II because of moderate erosion. Well suited to all general farm crops of this area, including potatoes. If soil fertility is built up, yields are good. Capability unit IIe–1.

Rayne silt loam, 5 to 12 percent slopes (Rb).—Except for strong relief, this soil is similar to Rayne silt loam, 0 to 5 percent slopes. About 11 percent of the area has many coarse sandstone fragments on the surface and throughout the soil. Erosion is generally moderate in all except the wooded areas. Typically, the upper horizons are thinner than on the more gently sloping Rayne silt loam, and the plow layer consists of some subsoil mixed with the original surface soil.

Conservation practices: If cultivated, the soil needs the protection of contour stripcropping and the diversion of water from long slopes.
Capability: Class II because of moderate erosion hazard. Well suited to general farm crops, including potatoes. Capability unit IIe–1.

Rayne silt loam, 12 to 25 percent slopes (Rc).—Except for greater slope, this soil is similar to Rayne silt loam, 0 to 5 percent slopes. On about a fourth of its total area, sandstone fragments make up 15 percent of the surface layer. Erosion is moderate on all except some of the wooded areas.

Conservation practices: Needs protection of close-growing crops at least 2 years in a 3-year rotation, plus contour stripcropping and the diversion of water from long slopes.
Capability: Class III because of serious erosion hazard. Suitable for all the general farm crops of the area, including potatoes. Capability unit IIIe–1.

Sciotoville Series

Soils of the Sciotoville series are deep moderately well drained soils on old alluvial terraces about 250 feet above present streams. Locally there are spots that are somewhat poorly drained. These soils are underlain by sand and gravel but have silty to very fine sandy soil material to depths of several feet. This may be alluvium deposited by slowly moving water or a layer deposited by wind. In Clarion County these soils occur only in the western part near Callensburg, Saint Petersburg, Foxburg, and Perryville. They are associated with the well drained Wheeling and the poorly drained Ginat soils.

The native vegetation was mixed hardwoods, including white oak, hickory, red maple, tulip-poplar, beech, and elm.

The total area covered by the Sciotoville soils is less than 4½ square miles. About 55 percent is cropped, 21 percent is idle, and 24 percent is wooded.

Sciotoville silt loam, 0 to 2 percent slopes (Sa).—Following is a typical profile of this soil in a cultivated area:

0 to 8 inches, very dark grayish-brown silt loam; weak fine granular structure.
8 to 10 inches, brownish-yellow silt loam; weak fine granular structure mixed with fine platy structure.
10 to 20 inches, yellowish-brown fine silt loam; moderately well developed subangular blocky structure; sufficient pore space for good permeability and aeration; friable.
20 to 40 inches, mottled yellowish-brown, strong-brown, and gray fine silt loam; moderately well developed medium blocky structure; dense and firm when moist and hard and brittle when dry; mottling becomes more distinct with depth.
40 to 60 inches, mottled yellowish-brown and gray fine silt loam; less dense than layer above; grades into stratified sand, silt, and gravel at depths of 48 to 72 inches.
60 inches +, bedrock may begin at 60 inches, or it may be up to 240 inches from the surface.

Erosion is mostly slight; moderate erosion on a few areas where water concentrates.

Management needs: This nearly level soil has just enough slope to have some surface drainage. In areas being cropped, drainage can be improved by digging intercepting drains that will carry away the surface water from higher lands before it reaches this soil.
Capability: Class II because of only moderately good drainage. Well suited to most general farm crops, but seasonal waterlogging often damages alfalfa and winter grains. Capability unit IIw–1.

Sciotoville silt loam, 2 to 8 percent slopes (Sb).—This soil is similar to Sciotoville silt loam, 0 to 2 percent slopes. Erosion is generally moderate; slight or none in wooded areas.

Conservation practices: Needs the same management practices as Sciotoville silt loam, 0 to 2 percent slopes. Also needs stripcropping and cultivation on a definite gentle grade to provide for orderly removal of excess surface water without ponding and without erosion.
Capability: Class II because of moderate erosion hazard and only moderately good drainage. This soil is suited to the same crops as Sciotoville silt loam, 0 to 2 percent slopes. Capability unit IIe–6.

Sciotoville silt loam, 8 to 15 percent slopes (Sc).—This soil is similar to Sciotoville silt loam, 0 to 2 percent slopes, but somewhat less uniform in depth, texture, and drainage. In some small areas gravel is on the surface. Included with this soil are some small spots of poorly drained soil, which are indicated by wet-spot symbols. Erosion is moderate in most areas, but severe in a few spots.

Conservation practices: Needs close-growing vegetation and stripcropping for erosion control.
Capability: Class III because of serious erosion hazard and only moderately good drainage. Suitable for the same crops as the more gently sloping phase. Capability unit IIIe–4.

Shelocta Series

In the Shelocta series are deep well-drained soils on lower slopes below uplands underlain by sandstone and shale. These soils have developed on soil material that has washed or slid down from the higher slopes. It has been in place and undisturbed long enough so that the soil now has a normal profile resembling that of the residual soils on the uplands. Shelocta soils occur in scattered areas in valleys between the foot of steeper slopes and the flood plain of streams. They are associated with the moderately well drained soils of the Ernest series and the poorly drained soils of the Brinkerton series.

The native vegetation was mixed hardwoods, mainly white oak, red maple, tulip-poplar, hickory, beech, and elm.

The total area is less than 300 acres. About 42 percent is cropped, and 30 percent is in pasture. The high proportion in pasture is mainly accounted for by the location of the soils close to flood plains and to the Ernest soils that are used for pasture.

Shelocta silt loam, 2 to 8 percent slopes (Sd).—Except for a small nearly level area, most of this soil occurs on gentle to moderate slopes. The soil is acid throughout.

Profile in a cultivated area:

0 to 8 inches, very dark grayish-brown crumbly silt loam; moderately well developed fine granular structure; shows some platiness where not recently plowed; friable and easily tilled.
8 to 28 inches, yellowish-brown silty clay loam; moderately stable medium-sized subangular blocky structure; porous and friable; slightly plastic when wet.
28 to 44 inches, light yellowish-brown silty clay loam; moderate medium blocky structure; firm in place; some gray coatings on blocks in lower part.
44 to 60 inches +, light yellowish-brown clay loam; weak coarse blocky structure; bedrock at 60 to 180 inches.

Erosion is moderate on four-fifths of the area.

Conservation practices: Under cultivation this soil needs the protection of contour stripcropping and a rotation that keeps a hay crop on the soil at least one-third of the time. Diversion of water reaching many areas of this soil from higher slopes is also needed.

Capability: Class II because of moderate erosion hazard. This soil is well suited to all locally grown crops. Most of the soil is cropped. Capability unit IIe–1.

Shelocta silt loam, 8 to 15 percent slopes (Se).—This soil is similar to Shelocta silt loam, 2 to 8 percent slopes. It occurs mostly on moderate slopes, but about one-tenth is on moderately steep slopes. Erosion is moderate in most areas; only a small part shows slight erosion, and even less shows severe erosion.

Management needs: Same as for the more gently sloping soil but needs more attention to erosion control.

Capability: Class III because of serious erosion hazard. Suited to the same crops as Shelocta silt loam, 2 to 8 percent slopes. Capacity unit IIIe–1.

Strip Mine Spoil

Surface strip mining of coal was extensively practiced in Clarion County during World War I and during and since World War II.

In strip mining, the overburden of soil and rock is moved to one side (fig. 7). The soil, shale, sandstone, and carbonaceous shales are thoroughly mixed. In the areas stripped before World War II, the spoil banks were not levelled. The last cut where coal had been removed remained as a channel through the coal until it was partly filled by slumping from the high wall and from the last spoil bank. Since then strip mines have been regraded to reduce the slopes, but a steep high wall usually remains. In very little of the strip-mined area in Clarion County has the soil been saved and returned to the surface after the rock was regraded. The typical levelled strip-mine area is, therefore, essentially raw soil material.

Exposed shales break down rapidly into fine shale chips. These chips and some silt and clay soon make a tight, slowly permeable surface layer. Acidity developed from weathering of the carbonaceous shales and waste coal is variable. It is frequently extremely strong but is soon reduced by leaching.

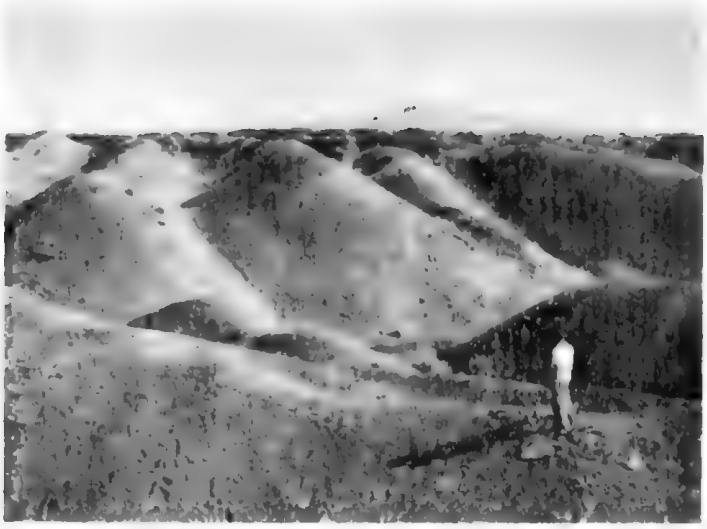

FIGURE 7.—Strip mine spoil, not leveled and not revegetated.

Revegetation is often difficult because of erosion, poor water-holding capacity near the surface, and the high temperature that develops near the surface of the bare shale (fig. 8). A few places have been planted to grass for development of pasture. Most of the areas are more suitable for revegetation with trees, shrubs, and vines.

FIGURE 8.—Partially successful planting of trees on unleveled strip mine spoil. Weathering has broken down most of the large rocks in the spoil bank.

The total area is not known exactly because strip mining has been in progress since the survey was made. Areas affected by these mines are increasing at the expense of those occupied by Gilpin, Cavode, and Wharton soils.

This miscellaneous land type is in land capability class VII, except for the steep, high-wall areas, which are in class VIII. Areas are indicated by the words "strip mine." Capability unit VIIe–2.

Tyler Series

Soils of the Tyler series are somewhat poorly drained. They occur on old stream terraces and in valleys at the same level as Holston and Monongahela soils, but they have developed on much finer sediments that apparently were laid down in standing rather than flowing water.

The Tyler soils have a silty surface soil, but underneath is dense and very slowly permeable, smooth, uniform silty clay. These soils are acid.

Included with this series are a few small areas of poorly drained soils that occupy the lowest spots in the Tyler areas.

The native vegetation was mixed hardwoods, mainly hickory, elm, red maple, and white oak.

The total area of Tyler soils in Clarion County is about seven-tenths of a square mile. About 29 percent is used for crops, 36 percent is idle, 18 percent is in permanent pasture, and 17 percent is wooded. The proportion of idle land and permanent pasture is accounted for by the poor drainage and the difficulty in cultivating these soils.

Tyler silt loam, 0 to 2 percent slopes (Ta).—Where it lies close to hillsides, this soil is likely to be somewhat stony; elsewhere it is free of stones. It occurs in nearly level areas where surface drainage is slow. In woods and old pastures the surface is hummocky.

Following is a typical profile:

0 to 3 inches, dark grayish-brown silt loam; weak fine granular structure; normally friable.
3 to 8 inches, very pale brown silt loam; weak, easily broken, fine platy structure; friable to moderately firm.
8 to 12 inches, very pale brown heavy silt loam; moderately expressed medium subangular blocky structure; firm in place; slightly plastic when wet.
12 to 30 inches, strongly mottled grayish-yellow, yellowish-brown, and strong-brown silty clay; strong medium blocky structure; blocks arranged one on top of another in prisms; firm when moist and plastic when wet.
30 to 48 inches, gray silty clay with some brown and yellow mottling; strong coarse blocky structure; firm when moist and plastic when wet.
48 inches +, stratified silts and clays.

Below 12 inches the soil is very tight and slowly permeable when moist. Some large cracks develop when it dries out. Erosion is generally slight.

Conservation practices: Where cultivated or used for improved pasture, rather thorough surface drainage is needed. This is fairly hard to obtain because of the nearly level surface and the very slow subsurface movement of water.

Capability: Class III because of somewhat poor drainage and the difficulty in improving it. Where the drainage is improved, the soil is moderately well suited to shallow-rooted crops that can withstand wetness. Capability unit IIIw–1.

Tyler silt loam, 2 to 10 percent slopes (Tb).—This soil is similar to Tyler silt loam, 0 to 2 percent slopes. It occurs on gentle to moderate slopes. In some places the silty clay loam subsoil is mixed with remnants of the original silt loam surface soil. In these areas the plow layer is cloddy and less friable than normal. Surface drainage is easier on these slopes than on those of Tyler silt loam, 0 to 2 percent slopes, and also, more of this soil is cultivated than of the less sloping soil. Erosion is moderate.

Capability: Class III because of the combination of erosion hazard and moderately difficult drainage. This soil is moderately well suited to shallow-rooted crops that can withstand wetness. Capability unit IIIe–6.

Westmoreland Series

In the Westmoreland series are well-drained, moderately deep to shallow, upland soils that developed on mixed material weathered from sandstone and shale. Included in their parent material are limestone and calcareous shale in amounts that have a marked influence on the soil properties.

The soils occur in a few places in the western part of the county, mostly as bands on hillsides and on a few hilltops and long slopes. They are associated with the soils of the Gilpin and Cavode series and with the concretionary variants of the Wharton series.

The native vegetation was mixed hardwood forest. Chestnut and walnut are reported to have been more common than on most surrounding soils. White and red oaks, red and sugar maples, and hickory are now common trees on these soils.

The small amount of lime in the parent material has been sufficient to give the Westmoreland soils a higher natural fertility level than soils that developed from acid materials. Grasslands on these soils have a better cover of more desirable grasses than on the Gilpin soils.

The total area is about a half square mile. About three-fourths of this is used for crops.

Westmoreland silt loam, 0 to 5 percent slopes (Wa).—This soil is similar to Westmoreland silt loam, 5 to 12 percent slopes, the soil next described. Erosion is moderate.

Conservation practices: Generally needs the protection of contour stripcropping.

Capability: Class II because of demonstrated erosion, even on gentle slopes. Well suited to all general farm crops of the area. Practically all of this soil has been cleared, and more than four-fifths is cropped. Capability unit IIe–3.

Westmoreland silt loam, 5 to 12 percent slopes (Wb).—Following is a typical profile of this soil in a cultivated area:

0 to 7 inches, dark grayish-brown silt loam; moderately stable fine granular structure; friable and easily tilled; normally some sandstone or shale fragments on surface and mixed through layer.

7 to 24 inches, yellowish-brown heavy silt loam; moderately stable medium subangular blocky structure; friable and porous; blocky structure increases and becomes more distinct toward bottom of layer.
24 inches +, stratified shale, sandstone, clay shale, and limestone; depth to top of this layer varies from 18 to 36 inches.

The weathered soil is moderately acid, but the underlying material is neutral and in many places contains some free lime.

In the surface layer there are local spots of silty clay that are less friable than the rest of the layer. These spots are not extensive. Erosion is moderate in most areas because of the moderate slopes and fairly intensive cultivation. Abundant grass cover has helped to protect this soil against erosion.

Conservation practices: Needs contour stripcropping where cultivated.

Capability: Class II because of moderate erosion hazard. Well suited to pasture and hay and to all general farm crops of the area. Eighty-six percent of the acreage is in crops. Capability unit IIe–3.

Westmoreland silt loam, 12 to 25 percent slopes (Wc).—This soil is similar to Westmoreland silt loam, 5 to 12 percent slopes, except that the total depth to bedrock is a little less. The depth averages only about 20 inches. The soil occurs mostly as narrow bands around slopes. Erosion is moderate on about two-thirds of the acreage, and severe on about one-third.

Conservation practices: If cropped, needs to be farmed in contour strips and to be protected by a rotation that includes hay crops at least 2 years out of 4.

Capability: Class III because of risk of erosion. Well suited to the general farm crops of the area. More than three-fifths of the total acreage is cropped. Capability unit IIIe–2.

Westmoreland silt loam, 25 to 35 percent slopes, eroded (Wd).—This soil is similar to Westmoreland silt loam, 5 to 12 percent slopes. It differs in occurring on steep slopes as bands around the hills. Also it is shallower to bedrock. The average depth is about 15 inches. Erosion is severe in most areas.

Conservation practices: Needs the protection of good sod at all times except those brief intervals when it is being reseeded.

Capability: Class IV because of serious erosion hazard. Well suited to hay crops and to pasture. Capability unit IVe–1.

Wharton Series

The Wharton series consists of moderately well drained to well drained upland soils that developed on clay shale. The concretionary variant of this series developed on clay shale that is partly calcareous and contains some limestone and some iron concretions. The concretionary Wharton soils are a little better drained than the typical Wharton soils.

The Wharton soils without lime and iron concretions occur mostly in the northwestern part of the county in association with soils of the moderately well drained Cavode and the poorly drained Armagh series. The Wharton soils that have concretions are at many places in the western and southern parts of the county where clay shale is associated with the Vanport ferriferous limestone.

The native vegetation was mixed hardwoods and a few white pines and hemlocks. White, red, scarlet, and chestnut oaks, red maple, black cherry, tulip-poplar, and ash are common trees.

Wharton soils have a tight subsoil and an underlying clay shale. These impermeable layers impede movement of water in the soil, so intake of water is slow and runoff is high. The fine-textured surface soil is rather easily dispersed and erodes readily. The suitability of Wharton soils for crops is somewhat limited because aeration and drainage are not entirely satisfactory.

The total area is about 8 square miles. More than three-fifths is cropped, and about one-sixth is wooded.

Wharton silt loam, 0 to 2 percent slopes (We).—This soil has a profile like that of Wharton silt loam, 2 to 8 percent slopes. Erosion is slight in most areas.

Conservation practices: Needs to be cultivated on a slight but definite grade to improve surface drainage.

Capability: Class II because of the slightly impeded drainage. Well suited to most general crops of the area. Alfalfa occasionally may be damaged when the entire soil becomes temporarily waterlogged. Capability unit IIw–1.

Wharton silt loam, 2 to 8 percent slopes (Wf).—This soil has only a few sandstone or shale fragments on the surface. It is acid throughout, except where the reaction of the surface soil has been changed by liming.

Profile in a cultivated area:
0 to 8 inches, very dark brownish-gray silt loam; weak fine granular structure; friable; shows weak platy structure between 2 and 4 inches if undisturbed for a few years as in a pasture or an idle field.
8 to 24 inches, dark yellowish-brown silty clay loam; moderately strong fine to medium subangular blocky structure; somewhat plastic when wet, friable when dry.
24 to 28 inches, yellowish-brown silt loam with faint fine mottlings of gray and strong brown; moderately well developed fine blocky structure.
28 to 32 inches, yellowish-brown silty clay loam mottled with gray and yellowish red; strong medium blocky structure; both in this layer and one above, where drainage is better, mottling is distinctly yellowish brown and red.
32 to 60 inches +, grayish-brown and gray silty clay; coarse platy structure, but breaks into blocks near top of layer; contains, in places, some bits of coal and carbonaceous shale; part of horizon is partially weathered clay shale.

Conservation practices: Soil needs contour stripcropping and a crop rotation that provides grass to help keep surface layer granulated and in good tilth. On long slopes, surface water should be diverted and led to safe channels.

Capability: Class II because of erosion hazard and slightly impeded drainage. Fairly well adapted to most farm crops. Alfalfa and winter grain are sometimes damaged by winterkilling but are successful in most years. Capability unit IIe–6.

Wharton silt loam, 8 to 15 percent slopes (Wg).—This soil is similar to Wharton silt loam, 2 to 8 percent slopes, but is somewhat less uniform in depth and averages a little shallower. Erosion is moderate in all except the wooded areas.

Conservation practices: Needs more attention to erosion control than Wharton silt loam, 2 to 8 percent slopes. Should not be planted to row crops more than 1 year in a 4-year rotation.

Capability: Class III because of serious erosion hazard and slightly impeded drainage. Suited to the same crops as Wharton silt loam, 2 to 8 percent slopes. Capability unit IIIe–1.

Wharton silt loam, 15 to 25 percent slopes (Wh).—Except for stronger slopes and thinner subsoil, this soil is similar to Wharton silt loam, 2 to 8 percent slopes. In many places some subsoil has been mixed with the surface layer to form a plow layer browner, finer textured, and less friable than the original surface soil. Erosion is moderate in cleared areas.

Conservation practices: Needs the protection of grasses and close-growing small grains for as much of the time as possible.

Capability: Class IV because of serious erosion hazard. Suited to the same crops as Wharton silt loam, 2 to 8 percent slopes. Capability unit IVe-3.

Wharton silt loam, concretionary variant, 0 to 5 percent slopes (Wk).—Except for its more gentle slopes and slightly deeper surface layer, this soil is like Wharton silt loam, concretionary variant, 5 to 12 percent slopes. Erosion is slight to moderate.

Conservation practices: Needs contour stripcropping and the use of a good crop rotation to protect the soil from erosion and to prevent breakdown of structure and puddling of the surface layer.

Capability: Class II because of moderate erosion hazard and, for much of the area, slightly impeded drainage. Well suited to all the general farm crops of the area. Capability unit IIe–1.

Wharton silt loam, concretionary variant, 5 to 12 percent slopes (Wl).—This soil has varying amounts of small sandstone fragments on the surface and throughout the profile. By volume, the fragments seldom make up more than 10 or 15 percent of the surface soil.

Profile in an area not disturbed by mining:

0 to 8 inches, brown to dark grayish-brown silt loam; weak fine granular structure; crumbly; friable and easily tilled; normally moderately acid; has a fair capacity for holding plant nutrients.

8 to 18 inches, strong-brown, fine-textured silt loam; moderate medium subangular blocky structure; abundant pores, and material is friable; acid.

18 to 24 inches, yellowish-brown or pale yellowish-brown silty clay loam; moderate medium blocky structure; fairly friable when moist but plastic when wet; acid.

24 to 36 inches, pale-brown silty clay with faint mottlings of gray and yellow; moderate medium blocky structure; firm and dense when moist, and plastic when wet; usually strongly acid; in many places contains lumps or nodules of iron ore; blocky aggregates normally coated with streaks of reddish brown and strong brown.

36 to 48 inches +, gray clay; firm in place, and plastic when wet; normally neutral in reaction; free lime in many places; layer normally contains nodules and boulders of Vanport ferriferous limestone.

Some areas of this soil were dug up about 100 years ago in search of iron ore. The iron concretions and nodules were used in local furnaces before development of the Lake Superior ore fields. These areas still have a rough surface and soil profiles are very mixed and irregular. Erosion is moderate in most areas, including some tracts of grazed farm woodland.

Conservation practices: Needs contour stripcropping and the diversion of water from long slopes.

Capability: Class II because of moderate erosion hazard. Suitable for all general crops of the area. Produces fairly well if ordinary practices for maintaining soil fertility are used. Capability unit IIe–1.

Wharton silt loam, concretionary variant, 12 to 30 percent slopes, eroded (Wm).—This soil occupies somewhat broken strips and patches on hillsides. Its slopes range from 12 to 30 percent, but only about a fifth of its acreage is steeper than 25 percent.

The soil has a wider range in texture and depth than Wharton silt loam, concretionary variant, 5 to 12 percent slopes. In some spots the surface soil is a silty clay loam and is less friable than for the less sloping Wharton silt loams. Some areas of this soil have been disturbed by quarrying for iron ore and for the Vanport limestone. Erosion is moderate in most areas, but a few have been so severely eroded that the subsoil is exposed.

Conservation practices: Needs the protection of close-growing crops for much of the time. The steeper areas should be kept in hay or pasture.

Capability: Class III because the slope and erosion are such that most of the soil belongs in this class. The areas so steep or gullied that regular tillage is not practicable should be in class IV. Soil well suited to general farm crops; produces well if ordinary practices for maintaining fertility are used. Capability unit IIIe–1.

Wheeling Series

The Wheeling series includes deep well-drained soils on gravelly terraces at an elevation of about 250 feet above the present streams. They are underlain by alternate layers of alluvial sand and gravel. The textures of the soils range from gravelly sandy loams to silt loams. The silt loams have developed in fine-textured material. This silty sediment may have been deposited by slowly moving waters or by wind.

These soils occur in the western part of the county in broad valleys which are much wider than the present deep narrow valleys of the Allegheny and Clarion Rivers. The largest areas are in the vicinity of Foxburg, Perryville, and Callensburg. The Wheeling soils are associated with the moderately well drained Sciotoville and the poorly drained Ginat soils.

The native vegetation was mixed hardwoods. White, red, and chestnut oaks and red and sugar maples now are common trees. Hickory, walnut, basswood, tulip-poplar, and black cherry also occur.

The silt loam soils, which make up most of the area, have moderately high moisture-supplying capacity, but the gravelly loams have only moderate capacity. The level to moderate slopes of the Wheeling soils, their depth, good drainage, and friable easily tilled surface soils all favor them for fairly intensive farming.

The total area is over 3½ square miles. Of this, about 62 percent is used for crops, 7 percent for permanent pasture, and 5 percent for townsites. Twelve percent is in woods; and 14 percent is idle.

Wheeling gravelly loam, 0 to 8 percent slopes (Wn).—This soil is similar to the Wheeling gravelly loam, 8 to 15 percent slopes. About 20 acres of this soil is nearly level; the rest is gently sloping. Erosion is moderate on most of the soil.

Conservation practices: Where cultivated, needs contour cultivation, supplemented by stripcropping and a rotation that helps maintain organic matter.

Capability: Class II because of moderate risk of erosion in all but the level areas. Well suited to all general farm crops of the area. Capability unit IIe–1.

Wheeling gravelly loam, 8 to 15 percent slopes (Wo).—This soil occurs on moderate slopes. Its textures range from gravelly loam to very gravelly sandy loam in small areas. The surface soil usually has between 10 and 30 percent gravel that is mostly derived from hard sandstone but includes some quartz pebbles. The soil is acid throughout and moderately low in plant nutrients. It has moderate moisture-supplying capacity. Permeability to water and plant roots is good, and the root zone is deep.

Profile in a cultivated area:

0 to 9 inches, very dark grayish-brown gravelly loam or gravelly sandy loam; very weak fine granular structure; friable and easily tilled.
9 to 20 inches, brown gravelly loam or heavy gravelly sandy loam; weak, easily broken, medium subangular blocky structure; very porous and friable.
20 to 42 inches, brown to dark-brown gravelly loam or gravelly sandy loam; weak poorly developed structure; open and friable.
42 to 72 inches, dark-brown gravelly sandy loam or gravelly loam; structureless; gradual transition to stratified sand and gravel, which is normally many feet thick; clay and silt fill some root channels and cracks; local spots of bedrock at depths of 60 to 72 inches.

Erosion is mostly moderate, but some areas where surface water concentrates have had severe erosion. There has been little or no erosion in wooded areas.

Conservation practices: Under cultivation, needs contour stripcropping and diversion of water from long slopes. Needs a cover of grasses and legumes about half the time to maintain organic matter and the rather weak soil structure.

Capability: Class III because of the moderately serious erosion hazard. Suitable for all general farm crops, including potatoes. Capability unit IIIe-1.

Wheeling silt loam, 0 to 2 percent slopes (Wp).—This soil is similar to Wheeling silt loam, 2 to 8 percent slopes but has a slightly thicker surface soil. Erosion is slight on much of this soil, but many gently sloping areas show moderate erosion because of the ease with which the fine silty surface soil moves in flowing water.

Conservation practices: Should be farmed in a rotation that includes grass for at least 1 year in 3; crop residues should be returned wherever possible to maintain organic matter and soil structure.

Capability: Class I. Well adapted to general farm crops of the area. Eighty-three percent of the total acreage is used for crops. Capability unit I–1.

Wheeling silt loam, 2 to 8 percent slopes (Wr).—This soil occurs on gentle slopes. It is acid throughout and has only a moderate capacity for storing plant nutrients. It is permeable and well aerated. The moisture-supplying capacity is moderately high.

Profile in a cultivated area:

0 to 10 inches, brown silt loam; weak fine platy and weak fine granular structure; granular structure is most common in tilled areas; friable and easily tilled.
10 to 18 inches, strong-brown silty clay loam or heavy silt loam; weak, easily crushed, fine subangular blocky structure; porous and friable.
18 to 27 inches, strong-brown silty clay loam to heavy silt loam; weak, fine, irregular blocky structure; friable to slightly firm.
27 to 35 inches, strong-brown sandy loam; massive structure; root channels and wormholes contain coatings of silt and clay; firm in place but porous; contains a few weathered pebbles and a few iron and manganese stains; depth to top of this layer varies from 20 to 40 inches or more.
35 to 60 inches +, stratified beds of sand and gravel; considerable iron and manganese coating; much of gravel is highly weathered.

The fine texture, weak structure, and absence of coarse stone fragments on the surface make this soil easily erodible. Erosion has been moderate on nearly all areas except part of the woodland. Some small areas are severely eroded and have lost all, or nearly all, of the original surface soil.

Conservation practices: Where cultivated, needs contour stripcropping and diversion of excess surface water from long slopes. Needs a rotation that includes hay crops at least 1 year in 4 and a return of crop residues. These practices help maintain the organic matter and the fairly weak structure of the surface soil.

Capability: Class II because of risk of erosion. Very well suited to a wide range of crops. Where normal liming and fertilizing practices are used, the yields are good. Capability unit IIe–1.

Wheeling silt loam, 8 to 15 percent slopes (Ws).—This soil is similar to Wheeling silt loam, 2 to 8 percent slopes but has a somewhat shallower surface soil. Erosion is moderate on about seven-eighths of the total area.

Management needs: Similar to those of the more gently sloping soil; needs special care in erosion control.

Capability: Class III because of risk of erosion. Crop suitability similar to that for the more gently sloping soil. Capability unit IIIe–1.

Wheeling silt loam, 15 to 25 percent slopes (Wt).—This soil is similar to Wheeling silt loam, 2 to 8 percent slopes, but shallower. It occurs on broken sloping edges and in rolling areas on the terraces occupied by

Sciotoville silt loams and other Wheeling silt loams. It is also somewhat less uniform than the other Wheeling silt loams, and it includes a few areas where internal drainage is a little slow. The surface soil, or the plow layer, averages about 7 inches thick, and the sandy loam below that layer is usually about 20 inches, or even less.

Conservation practices: Where cultivated, needs almost full-time protection of grass- and legume-hay crops. Should be plowed only to reseed hay in a nurse crop of small grain.

Capability: Class IV because of serious erosion hazard. Well suited to hay and pasture crops, including alfalfa. Capability unit IVe-1.

Soils and Their Environment

Climate, the kinds of rocks, the shape of the land, the plants and animals, and, recently, man and his machines have had a part in shaping the soils of Clarion County. The soils, in turn, have influenced flow of streams, vegetation, animal life, and man.

Climate

Clarion County has a humid, temperate climate. Precipitation is well distributed through the year (table 4). In June, July, and August there is a little more rainfall than in other parts of the year. The difference is not great, but it is important because water is most needed during the growing season. Twenty-four year records at Clarion show an average annual precipitation of more than 43 inches. On the basis of this average, the precipitation is well distributed. But there is wide fluctuation within any single year. In many summers and early autumns, periods of low rainfall last long enough to produce drought conditions on most of the soils. Much of the summer rain comes as intense thundershowers of short duration.

Weather records show that 0.4 inch of rain may be expected in a 5 minute period once every 2 years. A rainfall of as much as 0.6 inch in 10 minutes can be expected once every 2 years. About once in 25 years, an inch of rain will fall in 10 minutes. About half the years will have an inch of rain in 30 minutes, and 1¼ inches of rain in an hour will come about as often. Since most of the intense rains come in summer, when plants need water and much of the land is exposed to erosion, the need for holding and using the water is urgent.

About one-tenth of the total precipitation comes as snow. During an average year, there is about 80 days of snow cover, but this normally is not continuous. The snow protects the soil from frequent alternate freezing and thawing, safeguards living plant roots and micro-organisms at work in the soil, and helps to slow the breakdown of soil structure. Snow lasts longer on north slopes and in wooded areas, where it reduces frost penetration and slows the breakdown of rocks.

TABLE 4.—*Normal temperature and precipitation at Brookville Station, Jefferson County, Pa.*
[Elevation, 1,417 feet]

Month	Temperature [1]			Precipitation [2]			
	Average	Absolute maximum	Absolute minimum	Average	Driest year (1886)	Wettest year (1885)	Average snowfall
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*
December	28.0	67	−23	3.07	1.80	2.64	8.5
January	25.0	70	−29	3.20	3.79	4.53	11.6
February	25.2	70	−32	2.49	1.39	1.60	9.5
Winter	26.1	70	−32	8.76	6.98	8.77	29.6
March	34.0	83	−26	3.29	1.91	1.52	6.1
April	44.9	91	− 5	3.18	2.31	3.16	1.6
May	55.9	98	21	3.76	1.79	7.34	(3)
Spring	44.9	98	−26	10.23	6.01	12.02	7.7
June	64.1	101	28	4.28	1.63	3.63	0
July	68.1	105	33	4.37	1.79	5.47	0
August	66.0	100	32	3.73	1.16	13.28	0
Summer	66.1	105	28	12.38	4.58	22.38	0
September	60.3	95	24	3.14	3.13	2.91	0
October	49.6	93	15	2.99	1.11	5.68	.1
November	37.9	76	− 9	3.12	4.42	3.72	2.3
Fall	49.3	95	− 9	9.25	8.66	12.31	2.4
Year	46.6	105	−32	40.62	26.23	55.48	39.7

[1] Average temperature based on a 43-year record, through 1955; highest and lowest temperatures on a 22-year record, through 1930.

[2] Average precipitation based on a 64-year record, through 1955; wettest and driest years based on a 60-year record, in the period 1885-1955; snowfall, based on a 28-year record, through 1930.

[3] Trace.

Winter temperatures normally average a little below freezing, as judged from weather records at Brookville a few miles east of the county. Summer temperatures are warm and sometimes hot. Daily temperatures in winter and early in spring vary enough to cause frequent freezing and thawing of the soils. The freezing and thawing are most active on south and west slopes and where the soil has little or no vegetation on it.

The average frost-free growing season ranges from less than 120 days at higher elevations in the northeastern corner of the county to more than 140 days in the southwestern part. The actual growing season may be somewhat longer than the frost-free period, for most of the native plants and the crops grown are somewhat tolerant of frost.

Bedrock as soil material

All the soils of Clarion County are very closely related to the local rocks. The fairly small areas of

unconsolidated, water-deposited materials on the bottom lands and terraces, for the most part, have been moved only short distances from their source.

All the rocks exposed are sedimentary and belong to the Pennsylvanian series and the upper part of the Mississippian series. They were laid down in nearly horizontal beds or strata, but they were later bent and folded. Therefore, a given stratum is not always at the same level. The dip or rise of the rock formations is normally less than 100 feet per mile. There is a general gentle dip of the rocks toward the southwest, as well as a slight folding in a southeast-northwest direction.

POCONO FORMATION: The oldest rocks, members of the Pocono formation of the Mississippian series, are exposed in the valley along the Clarion River and in a few places along Mill Creek and Redbank Creek. The Pocono rocks are mostly hard, gray sandstones that include a little shale.

POTTSVILLE FORMATION: This formation belongs to the Pennsylvanian series and overlies the Pocono formation. The Pottsville rocks show on many hillsides and are close to the surface on most of the broad, flat ridgetops in the northeastern quarter of the county. The Pottsville formation contains massive sandstone, some shales, a few thin beds of coal, and some clay shales.

ALLEGHENY FORMATION: This formation overlies the Pottsville and is the most extensively exposed formation in the county. It contains shales, clay shales, sandstones, a couple of very thin layers of limestones, and nearly all the productive coal veins in this part of the State.

CONEMAUGH FORMATION: Some of the hills in the southern part of the county are capped by this formation, which is geologically the youngest bedrock in the county. It consists mostly of shale and fine-grained sandstone, with some clay shale.

Of the rock formations exposed in the county, more than a third classifies as shale, almost one-half as sandstone, and the remaining one-sixth as clay shale with a little limestone and coal.

The shales are mostly silty, but they include streaks of sand. The sandstones are variable in texture but normally they contain considerable silt and clay as impurities. The clay shales are fairly uniform while they are in the unweathered rocks. These clay shales are thin, and as they weather they become mixed with sandstone and silty shales from the nearby strata.

The distribution of soil textures depends on the distribution of rock formations in the geologic column. Sandy soils tend to be in the river valley and in the northeastern corner of the county, for it is in those areas where the sandy material of the oldest geologic formations are exposed. Sandy loams and coarse loams are in the areas where the coarse and hard sandstones are extensive. Finer textured soils are most extensive in the central part and in the northwest, as they have formed from the clay shales in the middle part of the geologic column. The soils developed from mixed shales of the upper part of the geologic column have medium textures, and silty material is dominant. In the areas where clay shales are extensive and soil development has been normal, a silty surface soil ordinarily overlies a silty clay or clay subsoil. The only areas of fine-textured, or clayey soils, are on eroded slopes.

Land forms

Clarion County lies in a dissected part of the Allegheny Plateau. Several stages of geologic erosion have sculptured the original gently folded rock strata. One stage of erosion reduced the entire plateau to a gently sloping plain, above which rose a few hills. In the northeastern quarter of Clarion County, this old plain now corresponds rather well with the level of the thick sandstones in the Pottsville formation (fig. 9). The

FIGURE 9.—View along Clarion River in northeastern part of county: Clymer and Cookport soils on ridgetops, Dekalb stony loams on steep slopes, Ernest silt loams and stony silt loams on lower slopes, and Philo and Atkins soils on flood plain.

level of the old plain has been preserved on the broad ridgetops that are underlain by the Pottsville rocks. The gently rolling ridgetops, with a few rounded hills rising above them have been cut by deep, steep-sided stream valleys. The ridgetops are at altitudes of 1,500 to 1,600 feet. The streams have cut down as much as 1,300 feet in their upper valleys, and up to 1,100 feet near the Clarion River. The highest point in the county, a knoll rising above the old plain north of Mill Creek near the eastern edge of the county, has an elevation of 1,912 feet. This knob is 600 feet above the creek that is only three-fifths of a mile away.

The sandstones of this part of the old plain are at least moderately permeable to water. The soils that developed on them are also moderately permeable. Only a small part of the rainfall is lost as runoff. Much water reaches underground storage and later appears as flow in springs.

Outside of the northeastern quarter of the county, geologic erosion has been more active and the general level of the old plain is marked only by scattered hills and fragments of ridges. In the northwestern and central parts, where clay shales predominate on the present land surface, there are some broad flats. Most

of the upland, however, has rounded, rolling surface, and the difference in elevation between the hilltops and stream valleys is 200 to 300 feet. The general elevation of the upland in these parts of the county is 1,400 to 1,550 feet. The slopes are abrupt only where thin beds of more resistant sandstone interrupt the uniform weathering and geologic erosion of the clay shales.

The clay shales and the soils developed on them are slowly permeable. Water runs off, so a complex pattern of surface drainage has formed. Underground storage of water is correspondingly reduced. Spring flow is not so strong nor so consistent as in the northeast, where the underlying rocks are dominantly sandstone.

In the southern part of the county geologic erosion has left a hilly land surface cut by a finely branching system of streams that reaches into all parts of the upland. The hilltops are 300 to 500 feet above the level of the valleys. The hard rocks that alternate with soft rocks in this area form benches or shelves on the hillsides. Some of the more pronounced benches appear to have been caused by geologic erosion during a time when stream valleys developed and widened at the level now marked by the benches.

The rocks in the southern part of the county are quite variable in permeability, and this quality has been transmitted to the soils in lesser degree. Water infiltrates well in much of the soil area that overlies siltstone and sandstone. Infiltration is much poorer for the soils that developed in clay shales. Where clay shales outcrop or come close to the surface on hillsides, there are many wet-weather springs fed from higher, more permeable strata. Many surface drains start from these wet-weather springs on the hillsides.

Along the Allegheny River, Clarion River, and Redbank Creek there are many terraces, or in other words, remnants of flood plains that were built by streams during an earlier erosional stage. At that stage, the streams must have remained at the same level long enough to cut much wider valleys than the streams now have. Near Foxburg, the old stream level is at an elevation of about 1,140 feet. In the tributary valleys, elevations vary somewhat.

Near Foxburg and Callensburg are local stratified beds of sand and gravel several feet thick. Much, but not all, of this Foxburg-Callensburg area is covered with a uniform blanket of coarse silt and very fine sand about 2 feet thick. This mantle may have been laid down by water that flowed less rapidly than the water that deposited the beds under the mantle. More likely, however, this mantle of silt and very fine sand was deposited by wind. It does not show definite horizontal stratification and occurs on varying slopes, which is evidence that it was laid down by wind.

Along Redbank Creek and some of the smaller tributary streams, the deposits on the old terraces are mostly silty material, though there are some strata of sand and some of clay. In a few areas affected by backwaters, fine clay deposits predominate. Penetration of water varies widely according to the texture of the material. The generally gentle slopes along the creeks have helped reduce geologic and accelerated erosion in all places except near the edges of the terraces.

Continental glaciers of the Pleistocene epoch apparently did not touch Clarion County, but at least three glacial ages are represented in northwestern Pennsylvania, and one of the early glaciers reached to within 12 miles of the northwestern boundary of this county.

With glaciation so close, the landscape of the county undoubtedly was affected by the unusual climate prevailing at the edge of masses of ice. During the glaciation, winters were cold, summers were short and cool, and snowfall probably was heavy. Avalanches, landslides, and mudflows over a frozen subsoil must have been common.

Most of the valleys in the southern and western parts of the county have deposits of soil material 4 to 20 feet deep to bedrock that have been brought down from adjacent slopes. The deposits give the valleys a typical rounded, or U-shaped, cross section. The deposits have been in place and undisturbed so long that the soil profiles are as fully developed as most of those on the ridgetops. They are more developed than the profiles on the stronger slopes.

There is geologic evidence that the interglacial periods were warmer than the present climate. Some of the soils in the valleys, as well as some of those on the ridges and terraces, show evidence of having developed partly under a climate typical of that now existing in more southern areas.

Erosion was rapid in the stream valleys after the streams cut down below the levels marked by the old terraces. The present valleys along the major streams are narrow and steep sided and have only small flood plains on which alluvium is still being laid down or shifted. Along the smaller streams in the agricultural sections, accelerated erosion of the uplands generally has caused a build-up of the flood plains. The flood plains are covered with very recent alluvium, and soil-building processes have not gone very far. The Allegheny River leaves the county at an elevation of 844 feet, which is about 600 feet below the highest hills in that corner of the county, and 1,068 feet below the highest knob in the county.

Vegetation and soils

The whole county was forested, most of it with hardwoods and scattered white pine and hemlock. Almost all of the county has been cut over for lumber or cleared for agriculture, so the exact composition of the original forest is not known.

The county is near the border between the region where beech, birch, and maple are dominant and the region where oaks, poplar, and chestnut are the main species. Because of this border position of the county the uplands have trees of both regions, along with black cherry, hickory, and many others. The range in species is even wider in the stream valleys, for seeds have been transported by the streams, and the soils on the flood plains provide good growing conditions.

Some specific relationships between soils and trees can be observed in the present woodlands. Oaks, chiefly white and red oaks, and red maple are almost universally distributed. Beech grows mostly on the somewhat

poorly and poorly drained soils. Hemlock and white pine are minor species on most of the soils but are much more abundant on some of the sandy soils of low natural fertility. The forest on Leetonia soils is almost entirely hemlock and white pine. The relationship between the conifers and low fertility is apparent. The highly acid litter from the conifiers hastens the leaching of bases from soils that are already low in bases.

In the southern part of the county, where Gilpin soils predominate, white oak, red oak, and red maple are the principal trees on most of the steep slopes. Many more kinds of trees are on the Ernest soils on the lower benches, and on the Rayne, Wharton, and Cavode soils of the ridgetops. On these soils, black cherry, ash, and chestnut oak are important trees. Hickories and some elms are on the poorly drained soils such as the Brinkerton and Armagh.

The brush that invades idle land consists of those kinds of trees and shrubs that produce abundant and easily transported seeds. Tulip-poplar and white pine make the most progress in old fields. In the fields, however, the trees grow up branching and with low crowns, and the pines often have multiple trunks. The trees therefore are not so valuable as those growing in a forest.

Sassafras, fire cherry, sumac, and aspen also come into the old fields, but they have little value aside from providing cover for the soils. Blackberries, dewberries, spireas, and shrubby dogwoods form fairly thick stands on many old fields. In some areas thornbrush and wild crabapples form thick stands. The crabapples and thornbrush are most common on the moderately well drained and the somewhat poorly drained soils. On the poorly drained soils—particularly the Atkins, Brinkerton, Armagh, and Lickdale—alders, elderberries, and spicebush form thick brush on the idle fields.

On idle fields and unfertilized pastures, grasses of low quality form most of the ground cover. Some old fields have fairly heavy stands of broomsedge. Povertygrass *(Danthonia spicata)* is the most common grass on most of the well drained, moderately well drained, and somewhat poorly drained soils. A number of the recently abandoned fields and some of the most eroded areas have only a partial cover that consists of annual weeds. On some shaly and very droughty spots, moss and lichens form a partial ground cover.

The Westmoreland soils and some of the concretionary variants of the Wharton and Cavode soils do not grow up to weeds and poor-quality grasses when fields are no longer cultivated. Bluegrass and wild white-clover persist on them and form much of the cover, even on fields that have been idle for a long time.

The poorly and very poorly drained soils support mainly sedges and a few coarse grasses.

Classification of Soils

Soil scientists arranged the different soil series in great soil groups. Soils in a great soil group have several characteristics in common although they may differ greatly in some characteristics, such as relief and thickness of profile.

One great group, known as Gray-Brown Podzolic soils, contains soil that where undisturbed have a thin humus layer, a dark-colored horizon, or surface soil, a leached grayish-brown horizon, and a subsoil (B horizon) that is brown or yellowish brown and in which clay has accumulated. Another great group, called Red-Yellow Podzolic soils, has thin organic and organic-mineral horizons, light-colored leached horizon, and a red, yellowish-red, or yellow B horizon that contains clay. Many of the extensive soils of Clarion County have some characteristics of both of these great soil groups and are regarded as intergrades between them rather than clear-cut members of one or the other.

Seven other great soil groups are represented in the county by soils that appear to belong in them or that have enough characteristics to make them intergrades. Lithosols are thin, undeveloped soils on consolidated rocks such as the sandstones and shales of Clarion County. Planosols contain in the subsoil a distinctive layer of plastic clay or a compact or cemented layer. Podzols are strongly acid soils that have an acid humus horizon, a very thin dark-gray horizon of mineral soil, a whitish-gray strongly leached horizon, a dark or coffee-brown upper B horizon, and a yellowish-brown lower B horizon. Sol Bruns Acides (Acid Brown Earths) are acid and strongly leached but do not have accumulated clay in the B horizon. Low-Humic Gley soils have surface horizons that are moderately high in organic matter over mottled gray and brown horizons that are not strongly differentiated in texture. Humic-Gley soils have poor or very poor natural drainage and consist of dark-colored surface soil over gray, usually saturated subsoil. Alluvial soils as a named great soil group include the soils forming in recent alluvial materials that show little development of horizons and do not have characteristics of the Humic Gley or of some other great soil group.

The soil series of Clarion County have been classified into these great soil groups as follows:

Gray-Brown Podzolic—Red-Yellow Podzolic intergrade:
- Clymer
- Cookport
- Ernest
- Holston
- Monongahela
- Rayne
- Shelocta
- Sciotoville
- Westmoreland
- Wharton
- Wheeling

Gray-Brown Podzolic—Lithosol intergrade:
- Gilpin

Red-Yellow Podzolic—Planosol intergrade:
- Cavode
- Tyler

Podzol:
- Leetonia

Sol Brun Acide:
- Dekalb

Low-Humic Gley:
- Armagh
- Brinkerton
- Ginat
- Nolo

Humic Gley:
- Atkins
- Lickdale

Alluvial:
- Philo
- Pope

Table 5 shows the relationships of parent material, drainage, and depth for the various soil series.

TABLE 5.—*Soil series of Clarion County arranged to show relationship of parent materials and drainage*

Principal parent materials	Well drained	Moderately well drained	Somewhat poorly drained	Poorly drained	Very poorly drained
Upland:					
Acid, gray and brown sandstone with some shale	Dekalb, Clymer	Cookport		Nolo	Lickdale.
Coarse, clean sandstone	Leetonia				
Acid, gray and brown shale, siltstone, and sand	Gilpin, Rayne				
Acid, gray clay shales		Wharton	Cavode	Armagh	Lickdale.
Mixed clay shales, with some limestone and some iron ore		Wharton (concretionary variant).	Cavode (concretionary variant).		
Mixed shale, sandstone, and limestone	Westmoreland				
Colluvial-alluvial lower slopes:					
Acid, gray and brown mixed silty and sandy materials	Shelocta	Ernest		Brinkerton	Lickdale.
Alluvial terraces, old, above flood plain:					
Silt and sand over stratified gravel and sand	Wheeling	Sciotoville		Ginat	Ginat.
Silt, clay, and fine sand	Holston	Monongahela			
Clay deposited in still water			Tyler		
Flood plains:					
Alluvial materials from acid sandstone and shale uplands	Pope	Philo		Atkins	Atkins.

Gray-Brown Podzolic—Red-Yellow Podzolic Intergrade

Soils of the Clymer, Cookport, Ernest, Holston, Monongahela, Rayne, Shelocta, Sciotoville, Westmoreland, Wharton, and Wheeling series are considered to be intergrades between two established great soil groups, the Gray-Brown Podzolic, and the Red-Yellow Podzolic.

These soils have the sequence of horizons and the colors and degree of structural development common for Gray-Brown Podzolic soils. Nevertheless, the base saturation, and to some extent the kinds of clays in the B horizons, are similar to those common for Red-Yellow Podzolic soils.

The soils more nearly typical for the Gray-Brown Podzolic group are the Sciotoville, Westmoreland, and Wheeling. In contrast, the soils of the Holston, Monongahela, and Wharton series are nearly like normal Red-Yellow Podzolic soils. Soils of the remaining five series—the Rayne, Shelocta, Clymer, Cookport, and Ernest—have an approximately even distribution of characteristics of both great soil groups.

Sciotoville, Westmoreland, and Wheeling series.—Soils of these series have undergone a moderate amount of leaching and have some concentration of clay in the B horizon because of the leaching. There is evidence that basic compounds in their parent materials still have some residual effect. Soils of these three series occupy only small areas; they resemble the Rayne soils in profile development but are less acid.

Rayne, Shelocta, Clymer, Cookport, and Ernest series.—These are the series that have about even distribution of characteristics belonging to two great soil groups. They are a little more acid and more deeply leached than is ideal for Gray-Brown Podzolic soils. In acidity and depth of leaching they resemble Red-Yellow Podzolic soils.

The Rayne and Shelocta soils cover reasonably large areas in the county and are the best examples of these intergrades.

Following is a profile description of Rayne silt loam on a gentle slope:

- A_{00} ¾ inch of mixed leaf litter from hardwoods.
- A_0 ¾ inch of mull consisting of well-rotted leaves mixed with a little mineral soil; black, acid, and contains many fine tree roots.
- A_1 0 to 3 inches, dark grayish-brown (10YR 4/2) silt loam; weak fine granular structure, with some platiness near bottom; very friable; pH 5.0.
- A_2 3 to 10 inches, light yellowish-brown (10YR 6/4) silt loam; weak fine to medium platy structure; friable; pH 4.8.
- B_{21} 10 to 15 inches, yellowish-brown (10YR 5/6) heavy silt loam; weak to moderate, fine to medium subangular blocky structure; friable; pH 4.8.
- B_{22} 15 to 25 inches, yellowish-brown (10YR 5/6) heavy silt loam to silty clay loam; moderate medium subangular blocky structure; friable; pH 4.8.
- B_{23} 25 to 36 inches, yellowish-brown (10YR 5/4) gritty silty clay loam; moderate medium blocky structure; firm; pH 5.0.
- C 36 inches +, partially weathered sandstone, siltstone, and shale; thin coatings of silt and clay on the rock fragments.

Clymer soils are deep, well drained, and well developed but are a little more podzolized than the Rayne and Shelocta.

Ernest and Cookport soils have only moderately good natural drainage. They have a hardened, platy layer, called a fragipan, in the lower part of their B horizon. Following is a representative profile of Cookport channery silt loam on a gently sloping wooded area:

- A_{00} ¾ inch of hardwood leaf litter.
- A_0 ¾ inch of black leaf mold that contains many tree roots.
- A_1 0 to 2 inches, black (10YR 2/1) silt loam; weak fine to medium crumb structure; friable; pH 4.8.
- A_2 2 to 7 inches, yellowish-brown (10YR 5/4) silt loam; weak fine to medium platy structure, mixed with some weak fine subangular blocky; friable; pH 4.8.
- B_1 7 to 10 inches, yellowish-brown (10YR 5/4) silt loam; weak fine to medium subangular blocky structure; friable; pH 4.8.
- B_{21} 10 to 24 inches, yellowish-brown (10YR 5/4) silt loam; slightly heavier than layer above, and a little gray

mottling in lower 3 inches; moderate medium subangular blocky structure; friable; pH 4.8.

B_{22g} 24 to 40 inches, strong-brown to yellowish-red (6.5YR 5/6) heavy silt loam; strongly mottled, and ped surfaces coated with light brownish gray (10YR 6/2) and light gray (2.5Y 7/1); weak thick plates are arranged in polygons; firm when moist, and hard when dry; pH 4.8.

C_1 40 to 48 inches +, blocky sandstone with silt loam in cracks.

Holston, Monongahela, and Wharton series.—These are intergrades that more nearly resemble Red-Yellow Podzolic soils than Gray-Brown Podzolic soils. They are intensively leached and low in available bases throughout the solum.

Following is a profile of Holston fine sandy loam near Hawthorne:

A_p 0 to 6 inches, very dark to dark grayish-brown (10YR 3/2 to 4/2) fine sandy loam; very weak fine granular structure; very friable; strongly acid.

A_2 6 to 12 inches, strong-brown (7.5YR 5/6) fine sandy loam or loam; moderate fine blocky structure, with some platiness; friable; strongly acid.

B_{21} 12 to 36 inches, yellowish-red to strong-brown (6YR 4/8 to 4/6) fine sandy clay loam; moderate medium and fine blocky structure; friable; strongly acid.

B_{22} 36 to 44 inches, same color and texture as above, but with some black iron coatings on peds; structure platy, and consistence firm.

C 44 inches +, yellow-red (5YR 5/6 to 5/8) gravelly sandy loam; loose single grain (structureless); some pebbles are weathered and soft, and others are hard and show little weathering; clay coatings give material slightly sticky consistence when moist; many black coatings on the pebbles; strongly acid.

Gray-Brown Podzolic—Lithosol Intergrade

Gilpin series.—The Gilpin soils on moderate slopes most nearly classify as Gray-Brown Podzolic, but on very steep slopes they are much shallower and have many of the characteristics of Lithosols. The profile of a Gilpin silt loam on a gentle slope is very similar to that of the Rayne in color and texture of the upper part, but the C horizon of partially weathered siltstone, sandstone, and shale is at depths of only 20 to 24 inches. On the steep slopes, Gilpin soils include some areas having more coarse fragments throughout the solum, and there is very little development of a B horizon.

Red-Yellow Podzolic—Planosol Intergrade

Cavode and Tyler series.—In this intergrade are two soil series having some characteristics of both Red-Yellow Podzolic soils and Planosols. Cavode soils have developed in acid clay shales. They have somewhat poorer drainage than is typical for Red-Yellow Podzolic soils in the county. They are transitional to another great soil group, the Planosols. In the upper part of their profile, the Cavode soils are similar to other Red-Yellow Podzolic soils. In the lower subsoil, however, there is clay or silty clay resembling that in the Planosols. The change to the clay or silty clay layer is not so abrupt as in typical Planosols. Apparently, the characteristics of the lower subsoil result more from the parent materials than from other factors of soil formation.

Following is a profile of Cavode silt loam taken on a slope of 7 percent in a woodland near Knox:

A_{00} 1 inch of mixed hardwood leaves, mostly from oak and maple.

A_0 ½ inch of black (5YR 2/1) mull.

A_1 0 to 4½ inches, very dark grayish-brown (10YR 3/2) silt loam; weak fine granular structure; friable; pH 4.8; lower boundary abrupt but wavy.

A_2 4½ to 8 inches, yellowish-brown (10YR 5/4 to 5/6) silt loam; weak medium platy structure breaking to medium granular; friable; pH 4.6; abrupt smooth lower boundary.

B_{21} 8 to 11 inches, yellowish-brown (10YR 5/6) heavy silt loam; moderate medium subangular blocky structure; firm; pH 4.6; clear wavy lower boundary.

B_{22g} 11 to 14 inches, very pale brown (10YR 7/4) silty clay loam mottled with strong brown (7.5YR 5/8); moderate medium blocky and subangular blocky structure; contains the tops of the prisms that show in the horizons below; moderately firm; pH 4.6; clear wavy lower boundary.

B_3 14 to 44 inches, silty clay loam; strongly mottled with gray (7.5YR 6/0), yellowish-red (5YR 5/8), and a little red (2.5YR 4/8); strong medium prismatic structure breaking to strong medium and coarse blocky; coarse blocky peds coated with about 1/16 inch of gray (10YR 6/0) clay; (many profiles lack the red colors in the mottling and have strong browns and yellowish browns instead); firm; pH 4.2; clear smooth lower boundary.

C 44 to 50 inches, gray (10YR 6/1) clay mottled with dark gray (6.5YR 4/0); strong medium blocky structure; very firm; pH 4.2.

Tyler soils are much like the Cavode. They are also Red-Yellow Podzolic soils intergrading to Planosols.

Podzol

Leetonia series.—The only soils of this great soil group in the county are the Leetonia. They are shallow soils that developed on the coarsest quartzitic sandstone in the county. The podzol B horizon in much of the Leetonia consists of pockets and lenses rather than a continuous layer. Hemlock and white pine grow on these soils.

Following is a profile of Leetonia stony sandy loam taken on a 5 percent slope near Cooksburg:

A_{00} 1 inch of dark-brown (7.5YR 4/2) litter of pine and hemlock needles and twigs.

A_0 1 inch of black (5YR 2/2) matted mor consisting of partly rotted needles and many fine tree roots.

A_2 0 to 5 inches, dark-gray (10YR 4/1) light sandy loam; structureless; loose; strongly acid; contains about 50 percent coarse sandstone fragments; abrupt wavy lower boundary.

B_1 5 to 8 inches, yellowish-brown (10YR 5/6) sandy loam; very weak granular structure; friable; strongly acid; thickness of this layer ranges from 0 to 3 inches; abrupt broken lower boundary.

B_2 8 to 30 inches, yellowish-brown (10YR 5/4 to 5/6) sandy loam; structureless; friable; strongly acid; contains 50 to 75 percent coarse sandstone fragments; gradual transition to next horizon.

C 30 inches +, broken gray sandstone with a little soil in the cracks.

On the surface of the soil are many scattered sandstone boulders, some of them several feet in diameter.

Sol Brun Acide

Dekalb series.—Soils of the Dekalb series belong to the Sol Brun Acide great soil group. The group consists of strongly leached acid soils that do not have a distinct increase in clay in the B horizon, and color contrast between the A and B horizons is small.

Following is a typical profile of Dekalb stony loam taken from an area occupied by second-growth oaks:

A_{00} 1 inch of hardwood leaf litter.
A_0 1 inch of thin, felty, mor; very dark brown to black (10YR 2/2 to 2/1); full of fine roots.
A_1 0 to 3 inches, dark to very dark grayish-brown (10YR 3/2 to 2/2) loam; very weak fine granular structure; loose; pH 4.4. (In many places where the soil has not been disturbed, this horizon is micro-Podzol.)
A_2 3 to 12 inches, yellowish-brown to light yellowish-brown (10YR 5/4 to 6/4) loam; weak fine platy structure; friable; pH 4.6.
B_{21} 12 to 18 inches, yellowish-brown (10YR 5/4) loam; weak medium to fine subangular blocky structure; friable; pH 4.8.
B_{22} 18 to 24 inches, yellowish-brown (10YR 5/4) loam; weak medium blocky structure; friable; pH 4.8; increasing amount of sandstone fragments in this horizon.
C_1 24 to 36 inches +, yellowish-brown (10YR 5/4) loam around broken sandstone fragments, which make up more than 85 percent of the mass.

Sandstone fragments, including a few boulders up to 30 inches in diameter, occur throughout the soil and are scattered on the surface.

Low-Humic Gley

Armagh, Brinkerton, Ginat, and Nolo series.—These members of the Low-Humic Gley great soil group are poorly drained and have a grayish-brown or gray surface soil. All the soils have either a fragipan or a claypan at shallow depths.

Profile of Armagh silt loam taken on a slope of 2 percent in a brushy field:

A_p 0 to 7 inches, very dark gray to black (10YR 3/1 to 2/1) silt loam; moderate medium granular structure; friable; strongly acid; clear lower boundary.
B_{21g} 7 to 14 inches, light brownish-gray (2.5YR 6/2) silty clay loam with fine mottles of strong brown (7.5YR 5/8); strong medium and fine subangular blocky and blocky structure arranged in prisms; blocks coated with grayish brown (2.5Y 5/2) silt; firm when moist, somewhat plastic when wet.
B_{22g} 14 to 20 inches, distinctly mottled strong-brown (7.5YR 5/8) and light brownish-gray (2.5Y 6/2) silty clay loam; weak fine subangular blocky structure; very strongly acid; firm consistence; contains a few small iron concretions and specks of coal; strongly acid; gradual lower boundary.
C_1 20 to 30 inches, strong-brown (7.5YR 5/8) gravelly silty clay loam with some gray (2.5Y 6/0) coatings on faces of peds; weak medium and fine subangular blocky structure; very firm; strongly acid; contains many iron concretions and angular sandstone fragments.

Humic Gley

Lickdale and Atkins series.—The soils of the Humic Gley great soil group are the Lickdale and Atkins. The Atkins soil differs from those classified as Low-Humic Gleys in occurring on flood plains along streams and resembles the Lickdale soils.

Lickdale soils are very poorly drained. They have 2 to 4 inches of mucky organic matter at the surface. The upper 6 inches of the mineral soil is black silt loam of moderate medium granular structure. Below this, the profile is very similar to that of the Low-Humic Gleys, as represented by the profile for the Armagh series.

Alluvial

Pope and Philo series.—The Alluvial great soil group is represented in this county by members of the Pope and Philo series. The profile of Alluvial soils depends on the order in which the materials were deposited, rather than on the interacting of soil-forming factors.

Early Settlement and Development

The first permanent settlements in what is now Clarion County were made along Redbank Creek in 1801 and 1802. Preceding these settlements hunters and traders visited the area. Also, Capt. Samuel Brady established and lost a homestead at East Brady soon after the Revolutionary War.

Early settlers raised some grain for their own food. The first gristmill was built in 1803 on Catfish Run. Early settlers depended on hunting for meat. Cash was obtained in part from forest products and from game. Pine tar from pine knots was one of the first products sold. Soon after settlement of the area, logs and lumber were being floated down the rivers to Pittsburgh. The first sawmill in the county was built at the mouth of Pine Creek in 1804. By the 1840's, lumbering and boatbuilding were major industries.

Clarion County was organized in 1839, from parts of Armstrong and Venango Counties. In 1840, the population was recorded as 15,590. Most of these people were in the southern part and in Richland Township. By the beginning of the Civil War, the population had risen to 24,980.

About 1830 the iron industry was started in the county. It lasted until around 1860, after which it declined and disappeared. At one time there were 27 iron furnaces operating at once and producing 40,000 tons of iron annually. As they were all charcoal fired, timber cutting and land clearing were hastened in the southern and western parts of the county. The search for ore and mining operations disturbed large areas of soil. Evidence of these operations can still be seen in some of the soils, especially in the concretionary variants of Cavode and Wharton.

Immediately after the Civil War, oil was discovered in the county. Oil-well drilling became an important industry around 1870 and was booming after 1878. An estimated 5,000 oil wells had been drilled in Clarion County by 1883. At that time fire clay was being mined, and some of it was being burned for firebrick and other wares. The iron industry was gone, and

along with it the production of charcoal. Coal mining was increasing. Lumbering had declined in most of the county. In the northern part there were large investments in pine forests that had not yet been lumbered.

Agriculture

The early settlers raised grain mostly for their own use and for sale. There was little need for livestock feed. This soon changed as game became scarce and the lumbering, iron, and oil industries developed. Hauling iron ore and charcoal and hauling in the oil fields required many horses. As a result, oats and hay became important crops on the farms near these industries. Also employment in these industries rapidly built up the population and local markets for food. There was a developing livestock and dairy industry on the farms.

Livestock and livestock products now account for more farm income than crops. The 1954 census divides total agriculture as follows:

	Percent
All crops sold	20.2
Livestock and livestock products sold	15.9
Dairy products sold	42.6
Poultry and poultry products sold	21.3

Continued increase in demand for feed crops has been partly offset by the shift from horses to tractor power. The amount of feed needed per farm, however, has almost doubled during the last 10 to 15 years. Present feed shortages are largely the result of the increased size of individual dairy herds. Formerly a dairy herd of 10 animals was usually enough for profitable operations. Today an economic operating unit usually has 20 or more animals. Sheep, on the other hand, have become scarce in the county. These changes have reduced the need for oats, timothy, and grass pastures. They have increased the need for corn, legumes, mixed hays, and improved grass-and-legume pastures. Much grain is used for poultry feed. These shifting needs have been partially reflected in the use of agricultural land. Some supplemental feeds are bought to balance the dairy and poultry rations. Improvement of hay meadows and pastures has not kept pace with the increase in number of livestock.

Surface mining of coal has affected agricultural use of the soils. During and immediately after World War I and from 1941 to the present, the stripping of overburden from coal seams near the surface has been active in the county. With large dragline equipment, stripping as much as 50 to 70 feet of overburden is common. For extensive operations, gently to moderately sloping areas that contain only 15 to 40 feet of overburden are favored. These stripping operations have resulted in the removal of large areas of soils favorable to agriculture. Soils of the Gilpin, Cavode, and Wharton series have been most affected. Spoils have covered some areas of soils and have been washed on to soils on the flood plains near the headwaters of some streams.

An estimated 7,000 acres of land in the county has been strip mined. About half of this has taken place since 1944. A much larger area is out of agricultural use as the result of strip mining. Often only a small part of a farm is stripped, but the entire farm is abandoned for agricultural use. A major part of the strip mining occurs in the better agricultural section of the county.

Land Use

In Clarion County 46.5 percent of the total land was in farms in 1954. There were 1,663 farms, and the average size of each farm was 107.2 acres.

In 1954 land in farms and use of land in farms were as follows:

	Acres
Land in farms	178,208
Cropland	89,908
Pasture (not cropland and not woodland)	20,860
Woodland	51,134
All other land	16,306

Principal crops

Corn, wheat, and oats have always been among the most important crops grown in the county (table 6).

TABLE 6.—*Acreage of the principal crops and number of bearing fruit trees and grapevines in Clarion County, Pa., in stated years*

Crop	1929	1939	1949	1954
	Acres	*Acres*	*Acres*	*Acres*
Corn total	13,974	15,320	13,051	12,471
For grain	10,012	12,661	10,805	10,150
For silage	3,253	2,428	2,095	2,260
Hogged or grazed, or cut for fodder	127	231	151	61
Small grains threshed or combined:				
Wheat	10,325	11,611	12,001	9,358
Oats	18,349	18,434	15,167	13,858
Barley	790	289	519	1,448
Rye	2,167	737	112	297
Buckwheat	6,095	3,458	2,252	1,298
Soybeans for all purposes	44	215	52	29
All hay	38,293	34,183	30,351	28,466
Alfalfa	235	664	1,738	6,399
Clover and timothy alone or mixed	32,663	30,324	27,717	20,346
Clover seed	758	908	[1] 1,280	[1] 952
White potatoes	1,325	1,224	467	129
Vegetables other than Irish and sweet potatoes harvested for sale	96	37	93	141
	Number [2]	*Number* [2]	*Number* [2]	*Number*
Apple trees	55,853	32,475	14,033	3,449
Peach trees	20,911	4,845	4,247	1,419
Pear trees	8,635	4,842	1,580	335
Plum and prune trees	8,146	2,436	1,119	453
Cherry trees	10,754	4,219	1,652	207
Apricot trees	5	1	18	([3])
Quince trees	41	4	([3])	([3])
Grapevines	6,728	3,755	1,950	563

[1] Number of acres of red clover seed.
[2] Number in the census year, which is 1 year later than the crop year given at the head of the column.
[3] Not reported.

During the last 15 years corn production has declined. In 1939, 511,645 bushels of corn were harvested for grain, and 24,171 tons were cut for silage. In 1954, 478,709 bushels of corn were harvested for grain, and 23,098 tons (green weight) were cut for silage.

Wheat yields have increased since 1939. In 1939, 230,966 bushels of wheat were threshed, and in 1954, 251,361 bushels. Oat yields have also increased. In 1939, 592,007 bushels of oats were threshed, and in 1954, 655,663 bushels.

Crop rotations

The generally used crop rotation is corn, oats, wheat, and 2 years of hay. The first year of hay is usually mixed red clover and grass, and the second year, grass with little or no clover. Timothy is the chief grass for hay, although some bromegrass and some orchardgrass are grown. In recent years a mixture of orchardgrass and Ladino clover has been used generally. The first cutting, made late in May or early in June, is stored as silage. The aftermath is pastured later in the season. Some alfalfa is grown, mostly on the deeper, better soils. Some alsike clover is used instead of red clover, or it is mixed with the red clover. Alsike clover is grown mostly on somewhat poorly drained and somewhat acid soils. Birdsfoot trefoil is being introduced, but more in pastures than in hay meadows. Rye, barley, and buckwheat are minor crops. Rye usually substitutes for wheat, and barley for oats. Buckwheat has no regular place in the rotation but usually is grown where a spring seeding of corn or oats has failed or where fertility is not high enough for more demanding crops. Today the trend is toward dairying, and winter grain is not so extensively grown as formerly.

Agricultural improvement programs

In the early agricultural history of the county, nothing special was done to maintain soil fertility. Land was cheap. Newly cleared land yielded well for a few years. When the yields became poor, the land was rested for a few more years, and new land was cleared. After the original fertility of the surface soil had been depleted, the need for building it up became apparent. A few farmers began to use fertilizing practices already in use in older parts of the State.

As farming became more complex and scientific, various programs aided its advance in the county. The Agricultural Extension program was one of the first. Through "Farmers Institutes" it brought to the farmers the results of research at the State College. Then, in 1916, an Agricultural Extension office was established. The extension program in the county has included teaching and demonstrating nearly all sorts of soil improvement and soil management practices.

The first Vocational Agriculture Department in the county was opened in Salem Township High School in 1929. Now there are departments in six schools. In their curriculum they include soils, land judging, and practical experience in crop production and in soil conservation.

Soil improving programs have been sponsored by farm organizations and local clubs. The Agricultural Conservation Program of the Federal Government, also, has helped pay for many soil-building and soil-conserving practices.

In 1935 the Civilian Conservation Corps established a work camp at Sligo for conservation work under the technical direction of the Soil Conservation Service. In 1941 the camp closed. Its work was done on farms in the southwestern part of the county and included tree planting, fencing woodlots, laying out contour stripcropping, constructing diversions, improving pastures, and planting shrubs for wildlife food and shelter.

In October 1938, Clarion County organized a soil conservation district. It was the fourth county in the State to organize a district, and the first in the State to have a district that covered an entire county.

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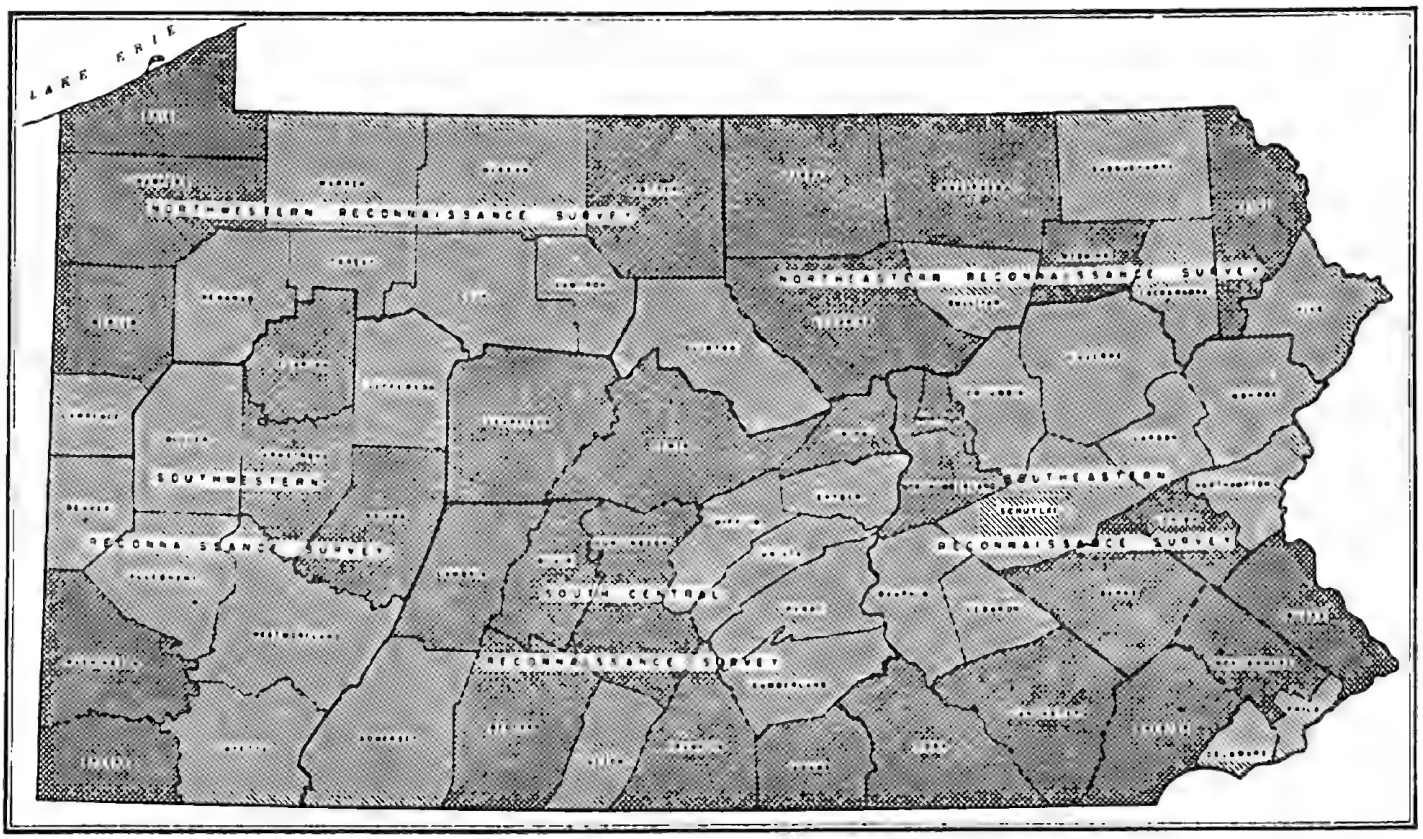

Areas surveyed in Pennsylvania: Reconnaissance surveys shown by northwest-southeast hatching; crosshatching indicates areas covered by both detailed and reconnaissance surveys.

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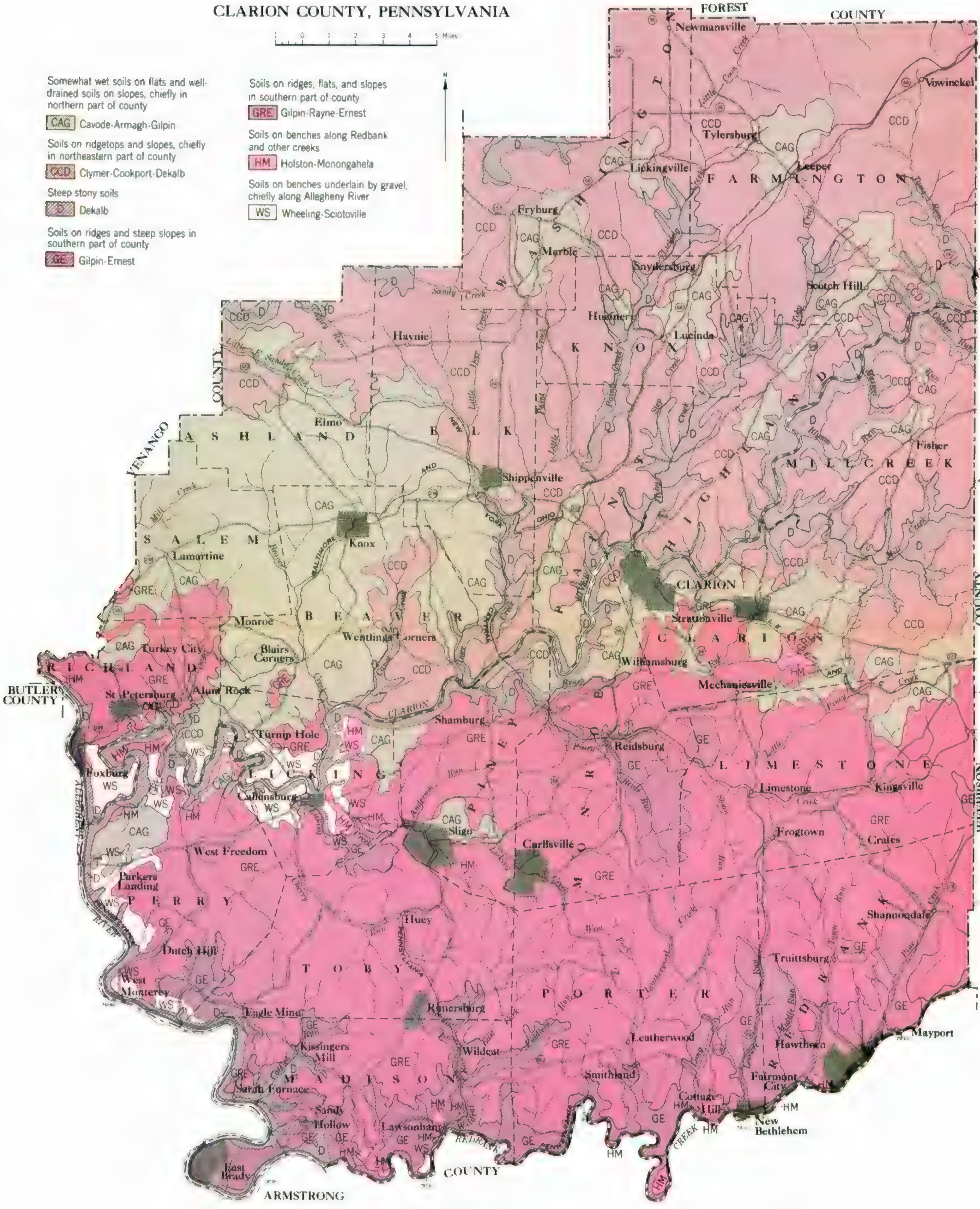
MAIN SOIL AREAS
CLARION COUNTY, PENNSYLVANIA



INDEX TO MAP SHEETS
CLARION COUNTY, PENNSYLVANIA

1 0 1 2 3 4 5 Miles

N

FOREST COUNTY

Newmansville 1 2

Vowinckel

3 4 Tylersburg 5

Licking Creek

Little Licking Creek

Licklingville

Leeper

FARMINGTON

Toms Run

Fryburg

6 7 Marble 8 9

Snydersburg

Scotch Hill

Sandy Creek

Huefner

Haynie

Lucinda

Cooley Run

Little E. Sandy Creek

Little Deer Creek

Paint Creek

Step Creek

Tubby Run

Caiber Run

Moose Run

10 COUNTY 11 12 13 14

Elmo

VENANGO 15 ASHLAND 16 17 ELK 18 HIGHLAND 19 MILLCREEK

Fisher

Blyson Run

Mill Creek

Shippenville

Little Toby Creek

NEW YORK AND OHIO

Knox

SALEM 20 21 BEAVER 22 PAINT 23 CLARION 24 COUNTY

Lamartine

Monroe

Weatlings Corners

BALTIMORE

Deer Creek

Central Creek

RIVER

Clarion River

Strattonville

Turkey City

Blairs Corners

RICHLAND

BUTLER COUNTY

St Petersburg

Alum Rock

25 26 27 28 29 30

Shamburg

Turnip Hole

Canoe Creek

CLARION

Brush Creek

Williamsburg

Mechanicsville

Piney Creek

Reidsburg

Foxburg

LICKING 31 32 33 34 LIMESTONE 35 36 JEFFERSON

Callensburg

Sligo

Curllsville

Limestone

Kingsville

Frogtown

Crates

Anderson Run

Reids Run

Sloan Run

ALLEGHENY

West Freedom

Parkers Landing

PERRY 37 38 39 40 41 42

Cherry Run

Huey

Dutch Hill

PENNSYLVANIA RIVER

TOBY

Truittsburg

Shannondale

West Monterey

Eagle Mine

Rimersburg

Kissingers Mill

43 44 45 46 47

Wildcat

Leatherwood

Hawthorn

Mayport

MADISON

Sarah Furnace

Smithland

Fairmont City

Cottage Hill

New Bethlehem

Sandy Hollow

Lawsonham

48 49 50

East Brady

REDBANK CREEK

ARMSTRONG COUNTY

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

CLARION COUNTY, PENNSYLVANIA

PENNSYLVANIA STATE UNIVERSITY COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION

SOILS LEGEND

SYMBOL	NAME
Aa	Armagh silt loam, 0-2 percent slopes
Ab	Armagh silt loam, 2-8 percent slopes
Ac	Armagh silt loam, 2-8 percent slopes, severely eroded
Ad	Armagh silt loam, 8-15 percent slopes
Ae	Armagh stony silt loam, 0-8 percent slopes
Af	Atkins silt loam, 0-5 percent slopes
Ba	Brinkerton silt loam, 0-2 percent slopes
Bb	Brinkerton silt loam, 2-10 percent slopes
Bc	Brinkerton stony silt loam, 0-8 percent slopes
Ca	Cavode channery silt loam, 2-8 percent slopes
Cb	Cavode channery silt loam, 8-15 percent slopes
Cc	Cavode silt loam, 0-2 percent slopes
Cd	Cavode silt loam, concretionary variant, 0-2 percent slopes
Ce	Cavode silt loam, 2-8 percent slopes
Cf	Cavode silt loam, 2-8 percent slopes, severely eroded
Cg	Cavode silt loam, concretionary variant, 2-8 percent slopes
Cgc	Cavode silt loam, concretionary variant, 8-15 percent slopes
Ch	Cavode silt loam, 8-15 percent slopes
Ck	Cavode silt loam, 8-15 percent slopes, severely eroded
Cl	Cavode silt loam, 15-25 percent slopes
Cm	Cavode silt loam, 15-25 percent slopes, severely eroded
Cn	Cavode silt loam, 25-35 percent slopes, eroded
Co	Cavode stony silt loam, 2-15 percent slopes
Cp	Cavode stony silt loam, 15-30 percent slopes
Cr	Clymer channery loam, 0-5 percent slopes
Cs	Clymer channery loam, 5-12 percent slopes
Ct	Clymer channery loam, 12-25 percent slopes
Cu	Clymer loam, 0-5 percent slopes
Cv	Clymer loam, 5-12 percent slopes
Cw	Cookport channery loam, 2-8 percent slopes
Cx	Cookport channery loam, 8-15 percent slopes
Cy	Cookport channery silt loam, 0-2 percent slopes
Cz	Cookport channery silt loam, 2-8 percent slopes
Cla	Cookport channery silt loam, 8-15 percent slopes
Clb	Cookport channery silt loam, 15-30 percent slopes
Clc	Cookport silt loam, 0-2 percent slopes
Cld	Cookport silt loam, 2-8 percent slopes
Cle	Cookport silt loam, 8-15 percent slopes
Clf	Cookport stony silt loam, 0-15 percent slopes
Clg	Cookport stony silt loam, 15-30 percent slopes
Da	Dekalb channery loam, 0-5 percent slopes
Db	Dekalb channery loam, 5-12 percent slopes
Dc	Dekalb channery loam, 12-25 percent slopes
Dd	Dekalb channery loam, 12-25 percent slopes, severely eroded
De	Dekalb channery loam, 25-35 percent slopes
Df	Dekalb channery loam, 25-35 percent slopes, severely eroded
Dg	Dekalb channery loam, 35-60 percent slopes
Dh	Dekalb channery sandy loam, 0-5 percent slopes
Dk	Dekalb channery sandy loam, 5-12 percent slopes
Dl	Dekalb channery sandy loam, 12-25 percent slopes
Dm	Dekalb channery sandy loam, 12-25 percent slopes, severely eroded
Dn	Dekalb channery sandy loam, 25-35 percent slopes
Do	Dekalb channery sandy loam, 35-60 percent slopes
Dp	Dekalb loam, 0-5 percent slopes
Dr	Dekalb loam, 5-12 percent slopes
Ds	Dekalb loam, 12-25 percent slopes
Dt	Dekalb stony loam, 0-25 percent slopes
Du	Dekalb stony loam, 25-35 percent slopes
Dv	Dekalb stony loam, 35-75 percent slopes
Ea	Ernest silt loam, 0-8 percent slopes
Eb	Ernest silt loam, 0-8 percent slopes, severely eroded
Ec	Ernest silt loam, 8-15 percent slopes
Ed	Ernest silt loam, 8-15 percent slopes, severely eroded
Ee	Ernest silt loam, 15-30 percent slopes
Ef	Ernest stony silt loam, 2-15 percent slopes
Eg	Ernest stony silt loam, 15-30 percent slopes
Ga	Gilpin channery loam, 0-5 percent slopes
Gb	Gilpin channery loam, 5-12 percent slopes
Gc	Gilpin channery loam, 12-25 percent slopes
Gd	Gilpin channery loam, 12-25 percent slopes, severely eroded

SYMBOL (continued)	NAME
Ge	Gilpin channery silt loam, 0-5 percent slopes
Gf	Gilpin channery silt loam, 5-12 percent slopes
Gg	Gilpin channery silt loam, 12-25 percent slopes
Gh	Gilpin channery silt loam, 12-25 percent slopes, severely eroded
Gk	Gilpin shaly silt loam, 0-5 percent slopes
Gl	Gilpin shaly silt loam, 5-12 percent slopes
Gm	Gilpin shaly silt loam, 5-12 percent slopes, severely eroded
Gn	Gilpin shaly silt loam, 12-25 percent slopes
Go	Gilpin shaly silt loam, 12-25 percent slopes, severely eroded
Gp	Gilpin silt loam, 0-5 percent slopes
Gr	Gilpin silt loam, 5-12 percent slopes
Gs	Gilpin silt loam, 12-25 percent slopes
Gt	Gilpin stony silt loam, 0-25 percent slopes
Gu	Gilpin stony silt loam, 25-60 percent slopes
Gv	Gilpin soils, 25-35 percent slopes
Gw	Gilpin soils, 25-35 percent slopes, severely eroded
Gx	Gilpin soils, 35-60 percent slopes
Gy	Gilpin soils, 35-60 percent slopes, severely eroded
Gz	Ginat silt loam, 0-5 percent slopes
Gla	Gravelly terraces, 12-25 percent slopes
Glb	Gravelly terraces, 25-45 percent slopes
Ha	Holston silt loam, 0-2 percent slopes
Hb	Holston silt loam, 2-8 percent slopes
Hc	Holston silt loam, 8-15 percent slopes
La	Leetonia stony sandy loam, 0-25 percent slopes
Lb	Leetonia stony sandy loam, 25-60 percent slopes
Lc	Lickdale silt loam, 0-2 percent slopes
Ld	Lickdale silt loam, 2-10 percent slopes
Le	Lickdale stony silt loam, 0-8 percent slopes
Ma	Monongahela silt loam, 0-2 percent slopes
Mb	Monongahela silt loam, 2-8 percent slopes
Mc	Monongahela silt loam, 8-15 percent slopes
Md	Monongahela silt loam, 15-25 percent slopes
Na	Nolo silt loam, 0-2 percent slopes
Nb	Nolo silt loam, 2-10 percent slopes
Nc	Nolo stony silt loam, 0-8 percent slopes
Pa	Philo fine sandy loam, 0-6 percent slopes
Pb	Philo silt loam, 0-6 percent slopes
Pc	Pope fine sandy loam, 0-5 percent slopes
Pd	Pope fine sandy loam, 5-8 percent slopes
Pe	Pope silt loam, 0-5 percent slopes
Ra	Rayne silt loam, 0-5 percent slopes
Rb	Rayne silt loam, 5-12 percent slopes
Rc	Rayne silt loam, 12-25 percent slopes
Sa	Sciotoville silt loam, 0-2 percent slopes
Sb	Sciotoville silt loam, 2-8 percent slopes
Sc	Sciotoville silt loam, 8-15 percent slopes
Sd	Shelocta silt loam, 2-8 percent slopes
Se	Shelocta silt loam, 8-15 percent slopes
Ta	Tyler silt loam, 0-2 percent slopes
Tb	Tyler silt loam, 2-10 percent slopes
Wa	Westmoreland silt loam, 0-5 percent slopes
Wb	Westmoreland silt loam, 5-12 percent slopes
Wc	Westmoreland silt loam, 12-25 percent slopes
Wd	Westmoreland silt loam, 25-35 percent slopes
We	Wharton silt loam, 0-2 percent slopes
Wf	Wharton silt loam, 2-8 percent slopes
Wg	Wharton silt loam, 8-15 percent slopes
Wh	Wharton silt loam, 15-25 percent slopes
Wk	Wharton silt loam, concretionary variant, 0-5 percent slopes
Wl	Wharton silt loam, concretionary variant, 5-12 percent slopes
Wm	Wharton silt loam, concretionary variant, 12-30 percent slopes, eroded
Wn	Wheeling gravelly loam, 0-8 percent slopes
Wo	Wheeling gravelly loam, 8-15 percent slopes
Wp	Wheeling silt loam, 0-2 percent slopes
Wr	Wheeling silt loam, 2-8 percent slopes
Ws	Wheeling silt loam, 8-15 percent slopes
Wt	Wheeling silt loam, 15-25 percent slopes

NOTE: Made land, mine dump, strip mine spoil, and gravel pit are shown by conventional signs.

Soils surveyed 1940-55 by Boyd J. Patton, Harold L. Donner, James D. Sheetz, J. B. Prettyman, A. L. Patrick, Jr., Lewis Ilgen, and J. R. Lauback, U. S. Department of Agriculture, and Carl Baures and Donald Leer, Pennsylvania Agricultural Experiment Station.
Correlation by W. J. Latimer, and A. J. Baur, U. S. Department of Agriculture.

Soil map constructed by Cartographic Division, Soil Conservation Service, USDA, from 1951 aerial photographs. Controlled mosaic based on polyconic projection, 1927 North American datum.

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Roads
- Good motor
- Poor motor
- Trail
- Marker, U. S. (33)

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail, foot
- Railroad
- Ferry
- Ford
- Grade
- R. R. over
- R. R. under
- Tunnel

Buildings
- School
- Church
- Station

Mine and Quarry
- Shaft
- Dump
- Prospect
- Pits, gravel or other

Power line

Pipeline

Cemetery

Dam

Levee

Tank

Mine tunnel

Forest fire or lookout station

Canal lock (point upstream)

BOUNDARIES

- National or state
- County
- Township, civil
- U. S.
- Section
- City (corporate)
- Reservation
- Land grant

DRAINAGE

Streams
- Perennial
- Intermittent, unclass.
- Crossable with tillage implements
- Not crossable with tillage implements

Canals and ditches (CANAL / DITCH)

Lakes and ponds
- Perennial
- Intermittent

Wells (flowing)

Springs

Marsh

Wet spot

RELIEF

Escarpments
- Bedrock
- Other

Prominent peaks

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

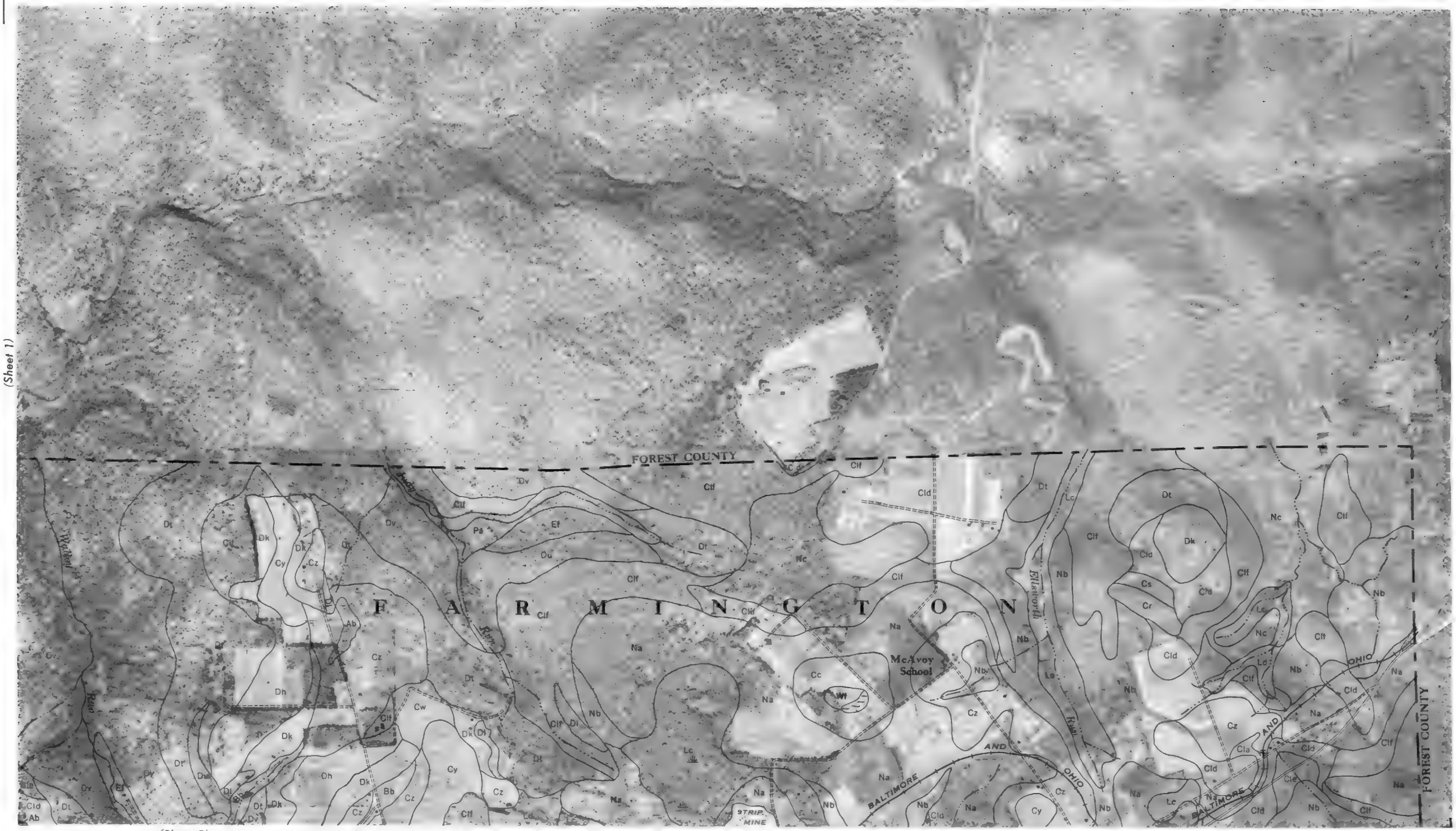
SOIL SURVEY DATA

- Soil type outline and symbol (Dx)
- Gravel
- Stones
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Erosion
  - Uneroded spot — U
  - Sheet, moderate — S
  - Sheet, severe — SS
  - Gully, moderate — G
  - Gully, severe — GG
  - Sheet and gully, moderate — SG
  - Wind, moderate
  - Wind, severe
  - Blowout
  - Wind hummock
  - Overblown soil
- Gullies
  - Crossable with tillage implements
  - Not crossable with tillage implements
- Areas of alkali and salts (A / M / S)
  - Strong
  - Moderate
  - Slight
  - Free of toxic effect — F
  - Sample location — • 26
  - Saline spot — +


FOREST COUNTY
FOREST COUNTY
WASHINGTON
(Sheet 1)
Wolfs Corners
(Sheet 3)
(Inset)
Newmansville
STRIP MINE
STRIP MINE
FOREST COUNTY
FARMINGTON
WASHINGTON
Kerr School
Creek
(Sheet 2)
(Sheet 4)
N
0
1/2
1 Mile
Scale 1:20 000
0
5000 Feet

(2)

N



(Sheet 1)

(Sheet 5)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

CLARION COUNTY, PENNSYLVANIA

(Inset Sheet 1)

3

N

FOREST COUNTY

FOREST COUNTY

W A S H I N G T O N

McCauley

Strobleton

Hemlock Creek

SIRIP MINE

(Sheet 4)

(Sheet 7)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

(4)

(Sheet 1)

N

(Sheet 3)

(Sheet 5)

(Sheet 8)

F A R M I N G T O N

W A S H I N G T O N

Fairs Corners

Licking ville

Tylersburg

Leeper

STRIP MINE

Scale 1:20000

0 ½ 1 Mile

0 5000 Feet

(Sheet 2)

5

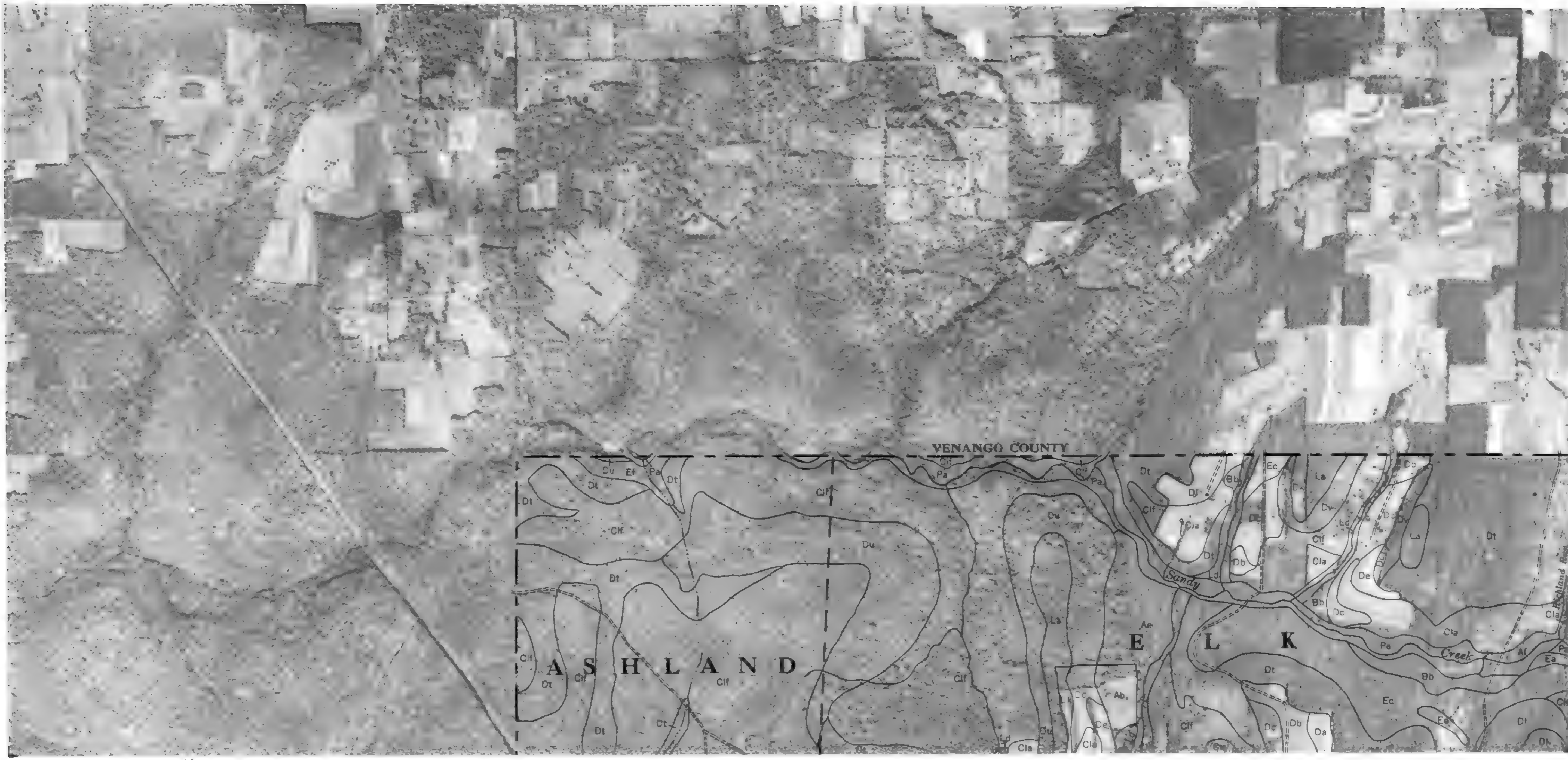
(Sheet 4)

(Sheet 9)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

6

N

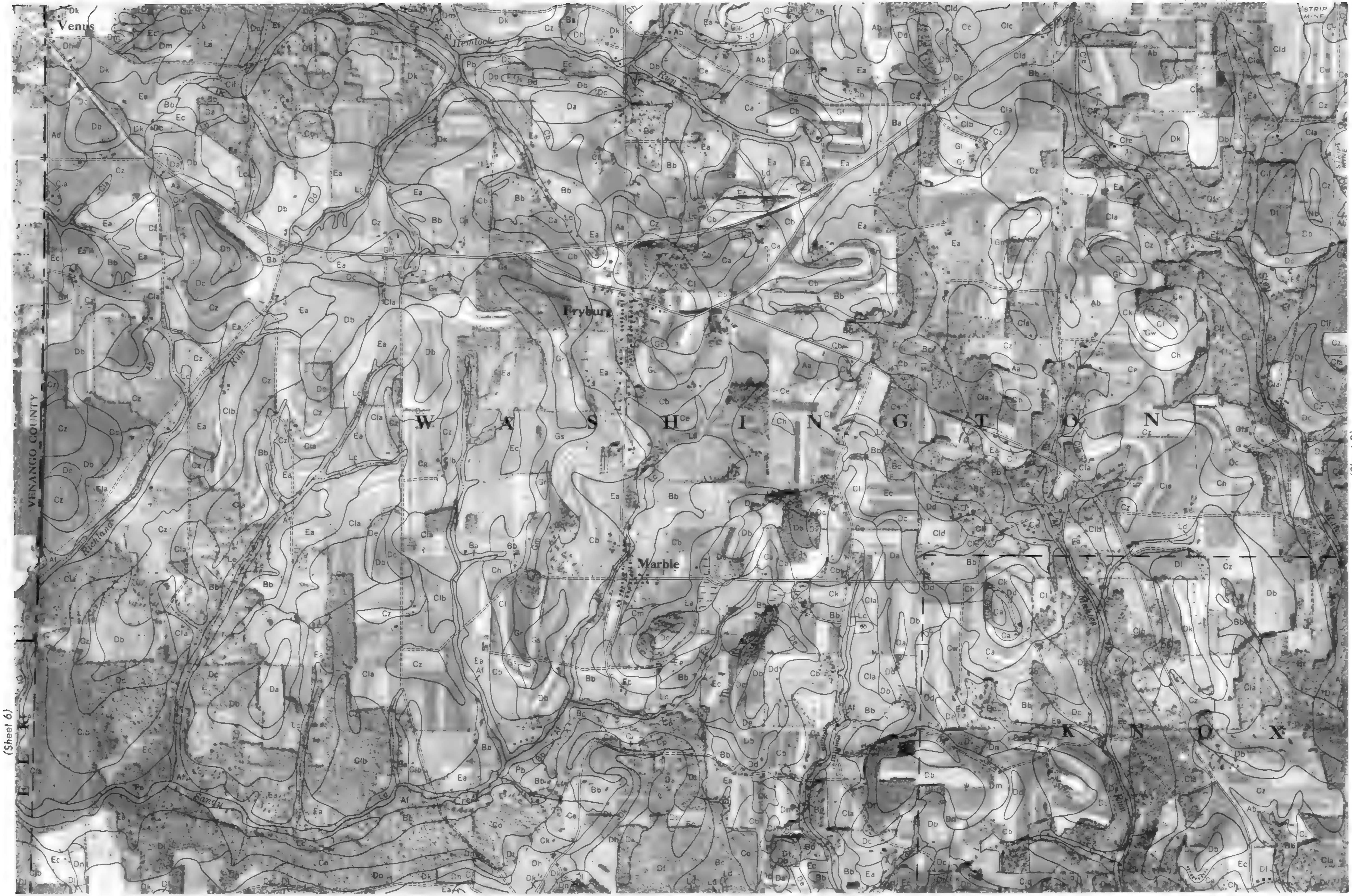


(Sheet 7)

(Sheet 11)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Sheet 3)



(Sheet 6)

(Sheet 8)

(Sheet 12)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

8

(Sheet 4)

(Sheet 7)

(Sheet 9)

(Sheet 13)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

(Sheet 5)

(Sheet 8)

N

FARMINGTON

Hefren

Brooks Run

Brooks Run

Powis

Henry School

Cooks Corners

Scotch Hill

STRIP MINE

FOREST COUNTY

CLARION RIVER

JEFFERSON COUNTY

(Sheet 14)

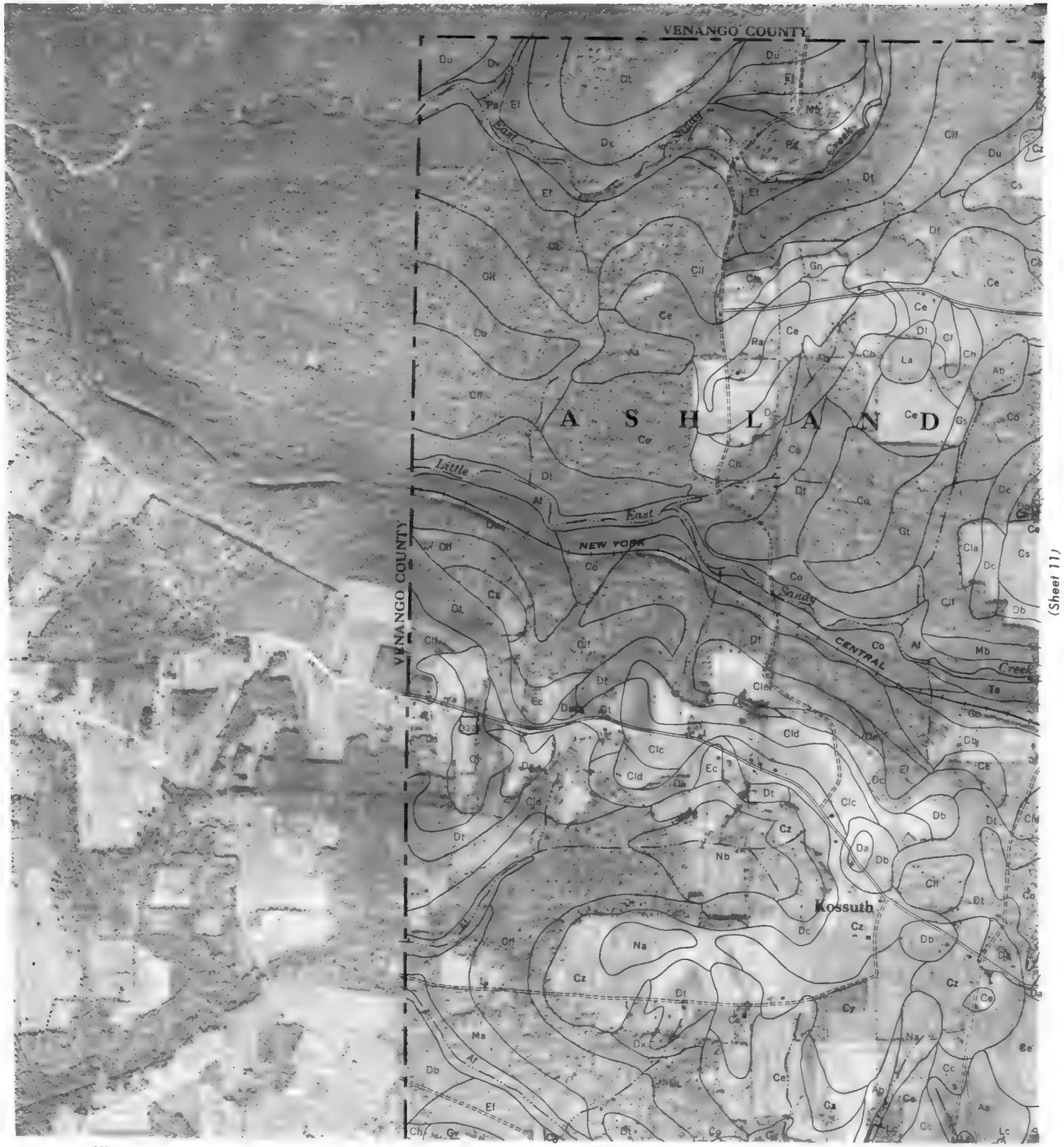
0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

(10)

N



(Sheet 11)

(Sheet 15)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

VENANGO COUNTY

A S H L A N D

B L K

Fern

Haymie

Billings

Couley Run

Little Bb Run

Sandy Creek

Deer Creek

NEW YORK CENTRAL

STRIP MINE

N

(Sheet 10)

(Sheet 12)

(Sheet 16)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

12

(Sheet 7)

N

W A S H I N G T O N

Millerstown

Cohlhepp School

Lauer School

STRIP MINE

Huefner

E L K

K N O X

P A T N T

(Sheet 11)

(Sheet 13)

(Sheet 17)

0 ½ 1 Mile

Scale 1:20 000

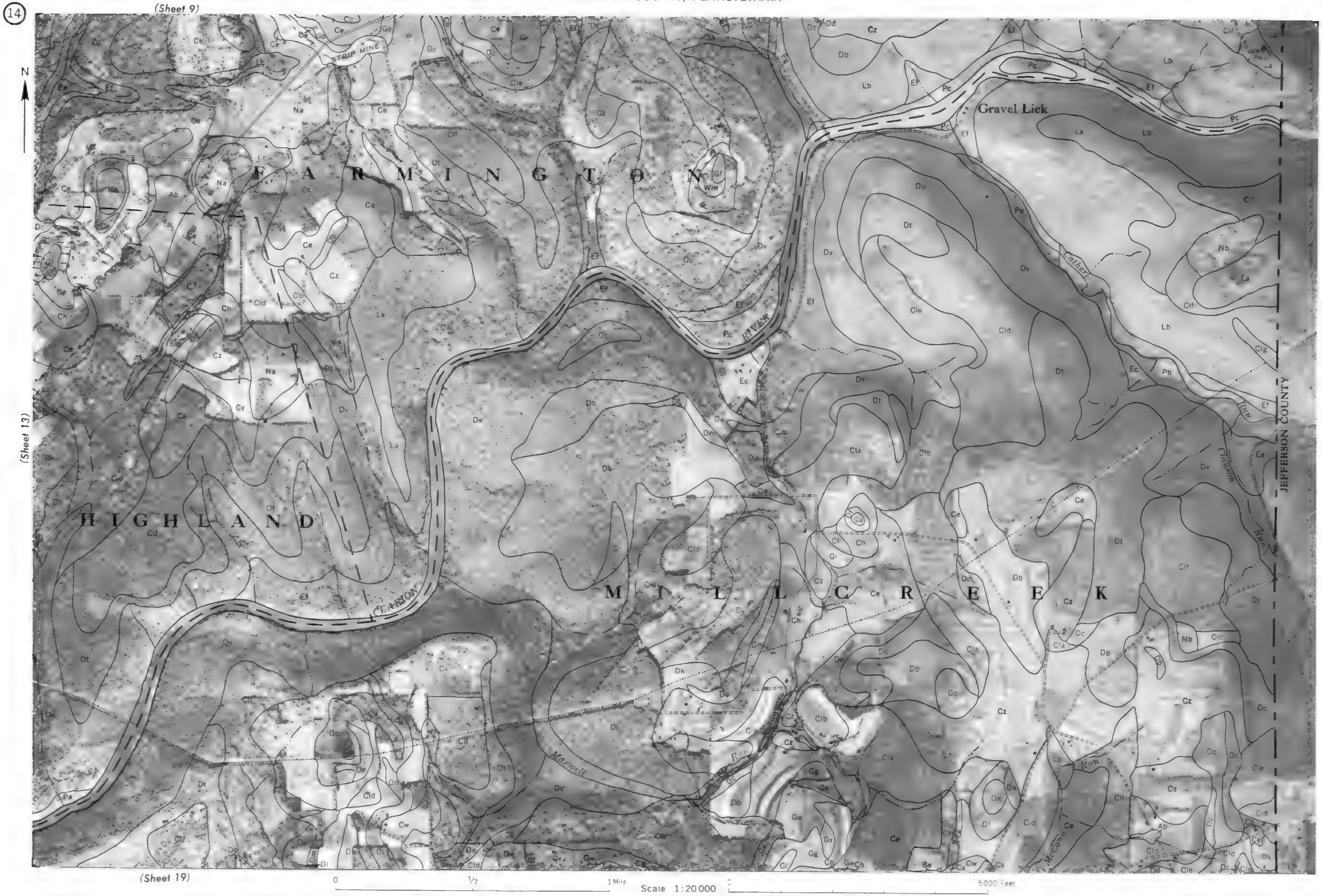
0 5000 Feet

(Sheet 12)

(Sheet 14)

(Sheet 18)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet


14
(Sheet 9)
(Sheet 13)
(Sheet 19)
JEFFERSON COUNTY
N
FARMINGTON
HIGHLAND
MILLCREEK
Gravel Lick
CLARION
RIVER
STRIP MINE
STRIP MINE
Maxwell
Run
Cather
Run
McCann
Run
0
1/2
1 Mile
Scale 1:20 000
0
5000 Feet

(Sheet 10)

VENANGO COUNTY

Altmanns Corners

Ninevah

A S H L A N D

S A L E M

Wilson

Brush Creek

Mill Creek

VENANGO COUNTY

(Sheet 16)

(Sheet 20)

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

16

(Sheet 11)

N

(Sheet 15)

(Sheet 17)

(Sheet 21)

ASHLAND

BEAVER

ELK

St Marks Church

Elmo

Knox

Elk City

NEW YORK CENTRAL

ALTOONA

OHIO

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

(Sheet 12)

(Sheet 16)

(Sheet 18)

(Sheet 22)

(18)

(Sheet 13)

N

PAINT HIGHLAND

MILLCREEK

CLARION

Highland School

Mio

TOBY CREEK

CLARION RIVER

CLARION CREEK

MILL Run

STRIP MINE

(Sheet 17)

(Sheet 19)

(Sheet 23)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

(Sheet 14)

N

Fisher

MILL CREEK

McNaughton Hill

Hyson Run

Strong Run

Wood Run

McCann Run

MILL CREEK

CLARION

JEFFERSON COUNTY

(Sheet 18)

(Sheet 24)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

(20)

(Sheet 15)

N

(Inset Sheet 25)

(Inset Sheet 25)

(Sheet 21)

VENANGO COUNTY

Lamartine

Kropps Corners

Monroe

Turkey City

Beaver Run

Beaver Creek

Ruth

Turkey

SALEM

RICHLAND

BEAVER

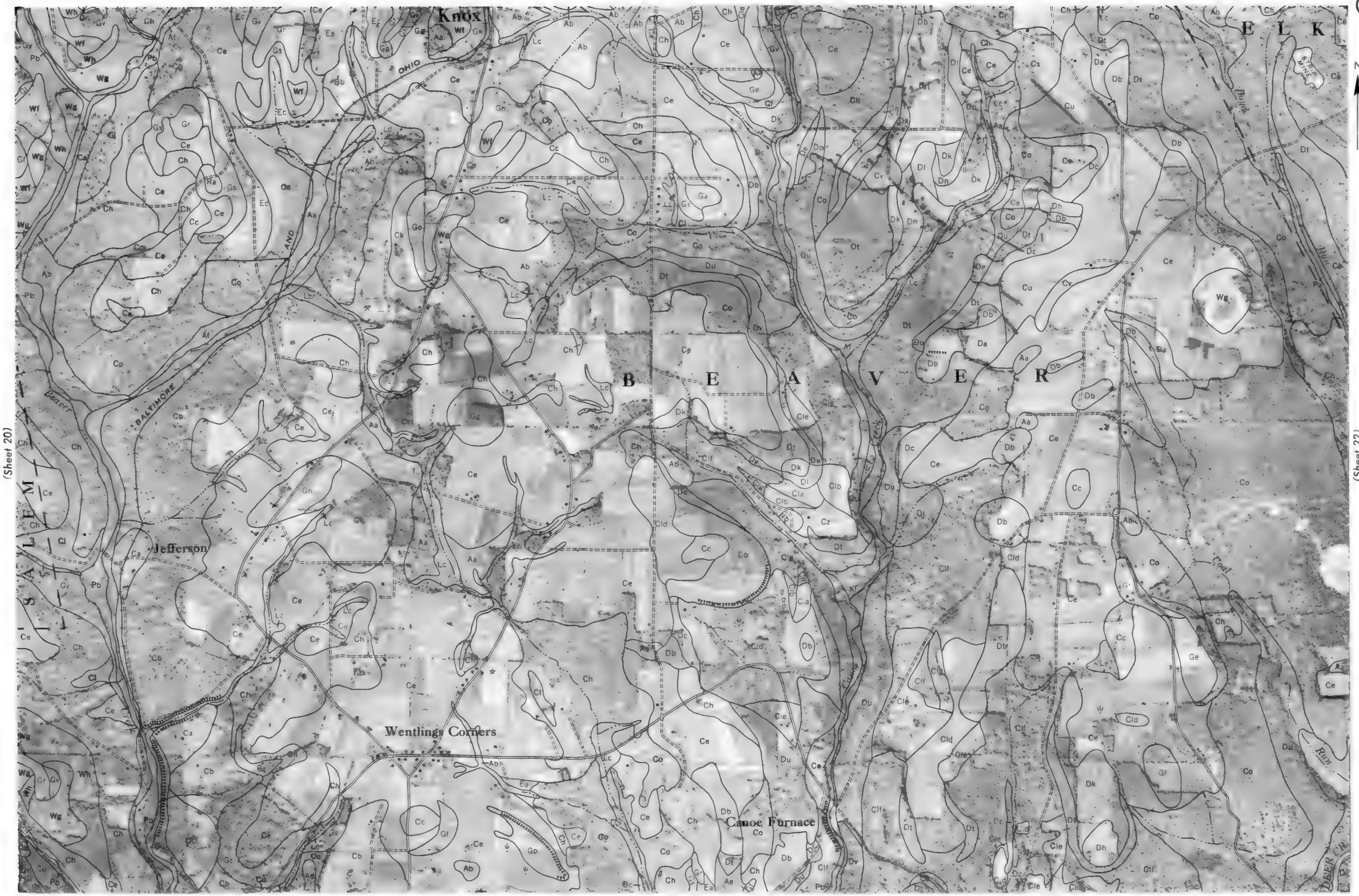
(Sheet 25)

(Sheet 26)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet



0 1/2 1 Mile

Scale 1:20000

0 5000 Feet

(22)

(Sheet 17)

N

(Sheet 21)

(Sheet 23)

Buckhorn School

Manor Church

Manor School

Beaver School

ELK

BEAVER

PAINT

PINEY

CLARION

MONROE

ELK CREEK

TORY CREEK

CLARION RIVER

NEW YORK DEER

CLARION POWER PLANT

STRIP MINE

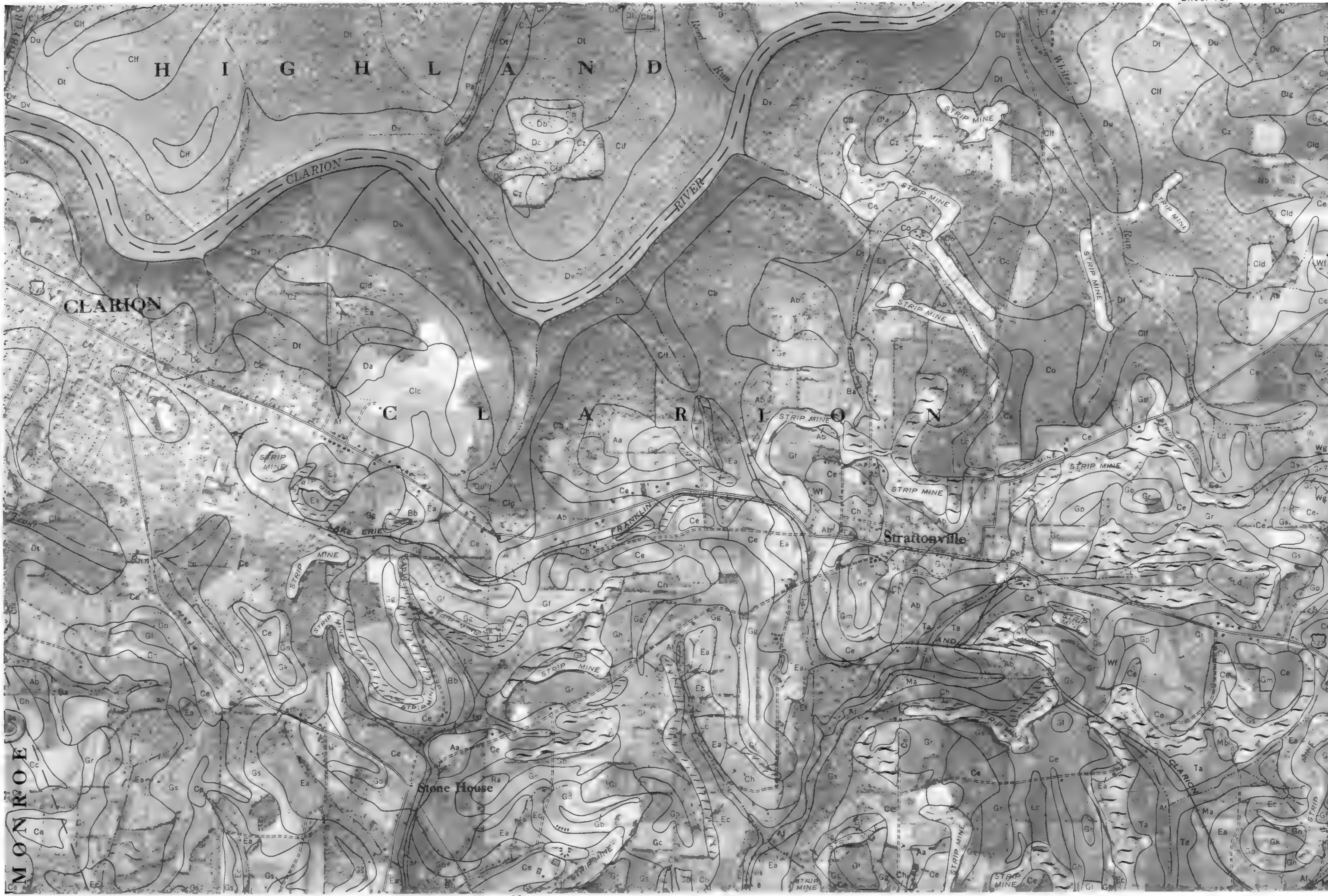
Trout

(Sheet 27) 0 ½ 1 Mile (Sheet 28)

Scale 1:20000

0 5000 Feet

(Sheet 18)

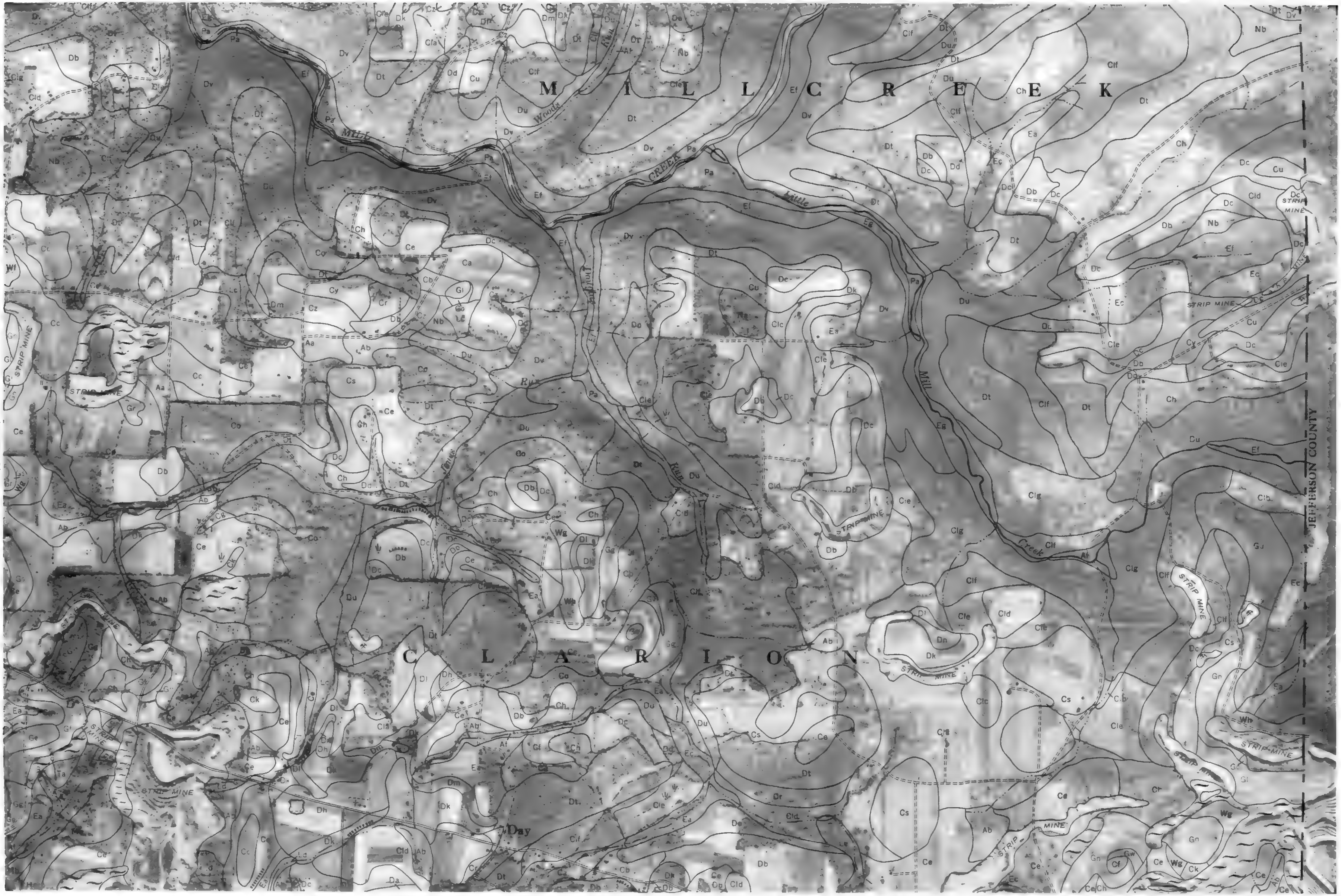


(Sheet 28) (Sheet 29)

0 1/2 1 Mile Scale 1:20000 0 5000 Feet

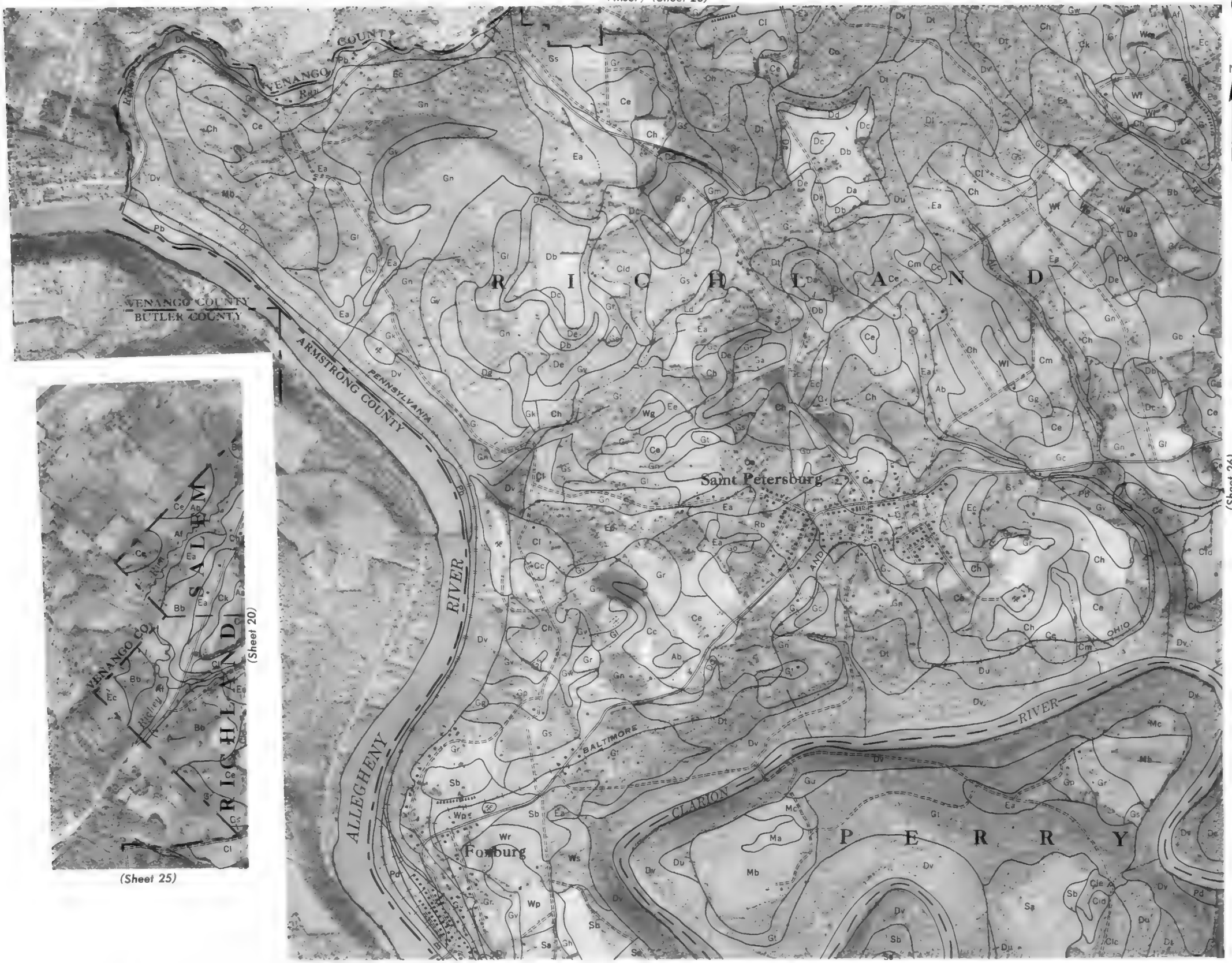
(Sheet 19)

(Sheet 23)



(Sheet 29) 1/2 (Sheet 30)

0 1 Mile Scale 1:20 000 0 5000 Feet


VENANGO COUNTY
BUTLER COUNTY
ARMSTRONG COUNTY
PENNSYLVANIA
R I C H L A N D
Saint Petersburg
ALLEGHENY RIVER
BALTIMORE AND OHIO RIVER
CLARION RIVER
P E R R Y
Foxburg
S A L E M
RICHLAND
VENANGO CO.
(Sheet 20)
(Sheet 25)
(Sheet 26)
(Sheet 31)
N
0
1/2
1 Mile
Scale 1:20000
0
5000 Feet

(Sheet 20) (Sheet 21)

N

Turkey City

Mairs Corners

Ritts

Alum Rock

Turnip Hole

BEAVER

RICHLAND

LICKING

PERRY

OHIO

ALLEGHENY

BALTIMORE

CLARION RIVER

(Sheet 25)

(Sheet 27)

(Sheet 32)

0 1/2 1 Mile

Scale 1:20000

0 5000 Feet

N

BEAVER

PINEY

LICKING

CLARION RIVER

TOWN CREEK

NEW YORK CENTRAL

PINEY CREEK

CANOE CREEK

STRIP MINE

Canoe Ripple

Piney

Shamburg

Zion Hill Church

(Sheet 26)

(Sheet 28)

(Sheet 33)

0 1/2 1 Mile

Scale 1:20000

0 5000 Feet

CLARION COUNTY, PENNSYLVANIA

(Sheet 22) (Sheet 23)

N

PAINT

CLARION RIVER

PINEY

MONROE

CLARION

Williamsburg

Reidsburg

Monroe School

NEW YORK CENTRAL

STRIP MINE

(Sheet 27)

(Sheet 29)

(Sheet 34)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

(Sheet 23) (Sheet 24)

(Sheet 28)

(Sheet 30)

(Sheet 35)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

CLARION COUNTY, PENNSYLVANIA

(Sheet 24)

N

(Sheet 29)

(Sheet 36)

JEFFERSON COUNTY

CLARION

LIMESTONE

Rader

Holden

Oak Hill School

Sutton

Pine Creek

Pine Creek

Franklin

Lake Erie

New York Central

Clarion

STRIP MINE

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

(Sheet 25)

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

32

(Sheet 26)

N

RICHLAND

CLARION RIVER

CLARION RIVER

Easton

Callensburg

L I C K I N G C R E E K

P E R R Y

West Freedom

T O B Y

STRIP MINE

(Sheet 31)

(Sheet 33)

(Sheet 38)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

(Sheet 27)

N

(Sheet 32)

(Sheet 34)

L I C K I N G

P I N E

T Ø B Y

Sligo

COUNTY HOME

STRIP MINE

PENNSYLVANIA

Scale 1:20000

0 ½ 1 Mile

0 5000 Feet

(Sheet 39)

(Sheet 28)

N

Earimer School

Five Points School

Burma

Churchville

Curllsville

MONROE

STRIP MINE

(Sheet 33)

(Sheet 35)

(Sheet 40)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

(Sheet 29)

N

(Sheet 34)

(Sheet 36)

NEW YORK

Limestone

Creek

Piney

Run

CENTRAL

Creek

L I M E S T O N E

STRIP MINE

STRIP MINE

Frogtown

Crates

Glade

Slippery Gap

P O R T E R

R E D B A N K

(Sheet 41)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

(36)

(Sheet 30)

N

Old Kingsville

Harlan

LIMESTONE

REDBANK

NEW YORK

CENTRAL

STRIP MINE

JEFFERSON COUNTY

(Sheet 35)

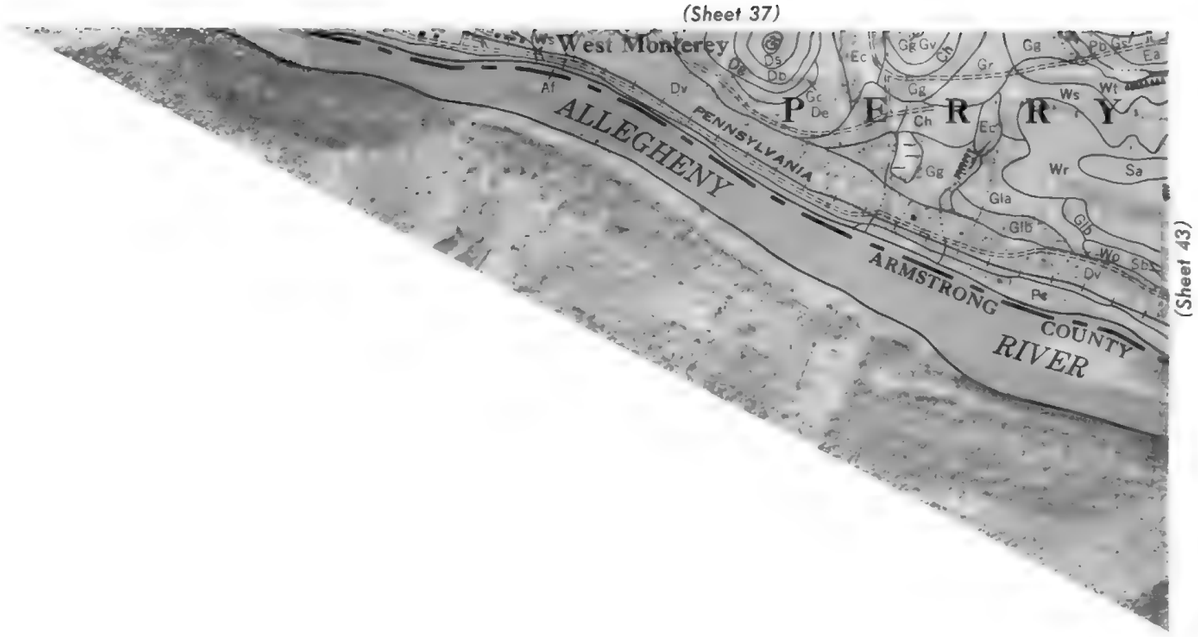
(Sheet 42)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

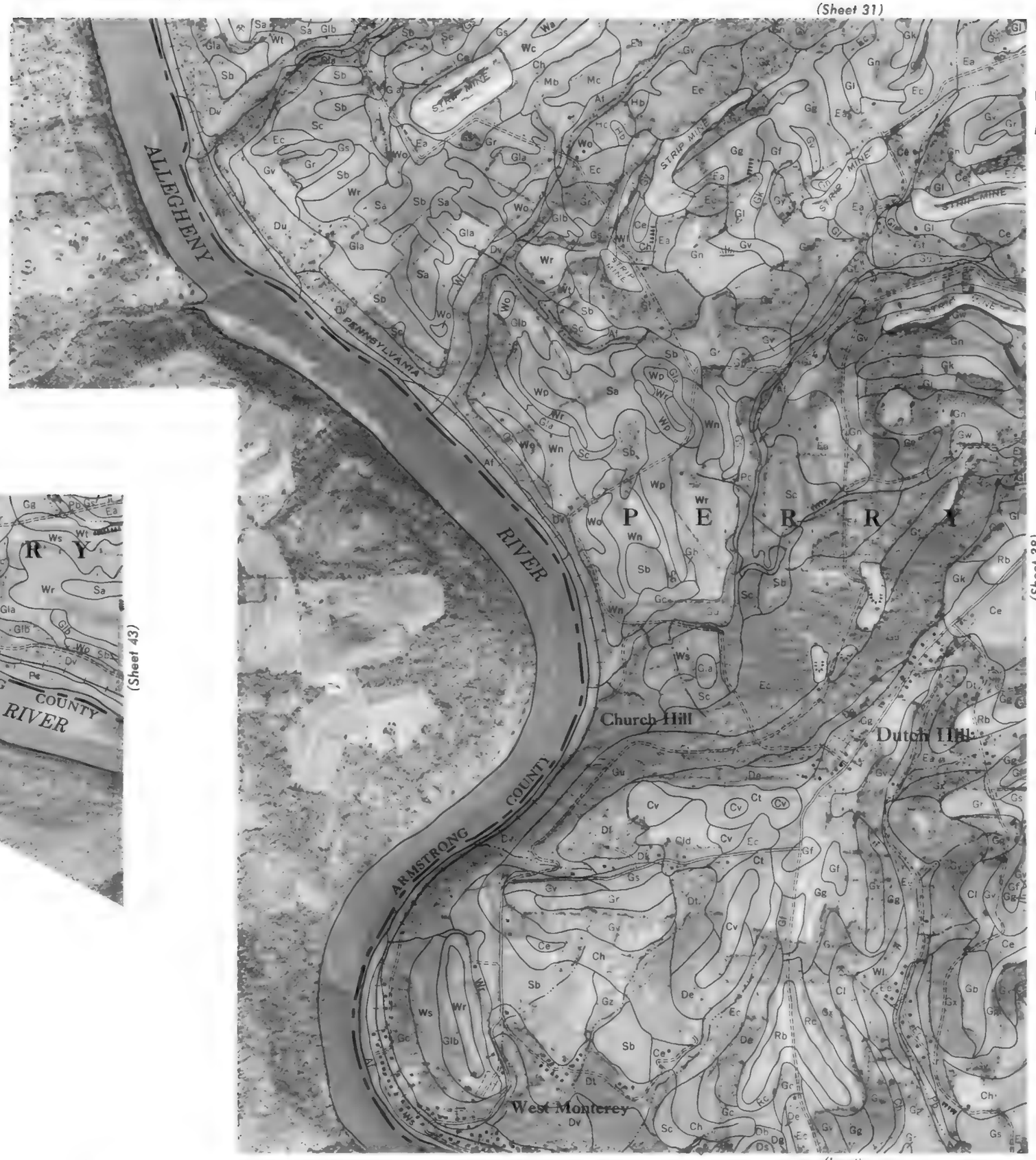
(Sheet 37)



(Sheet 43)

(Sheet 31)

37



(Sheet 38)

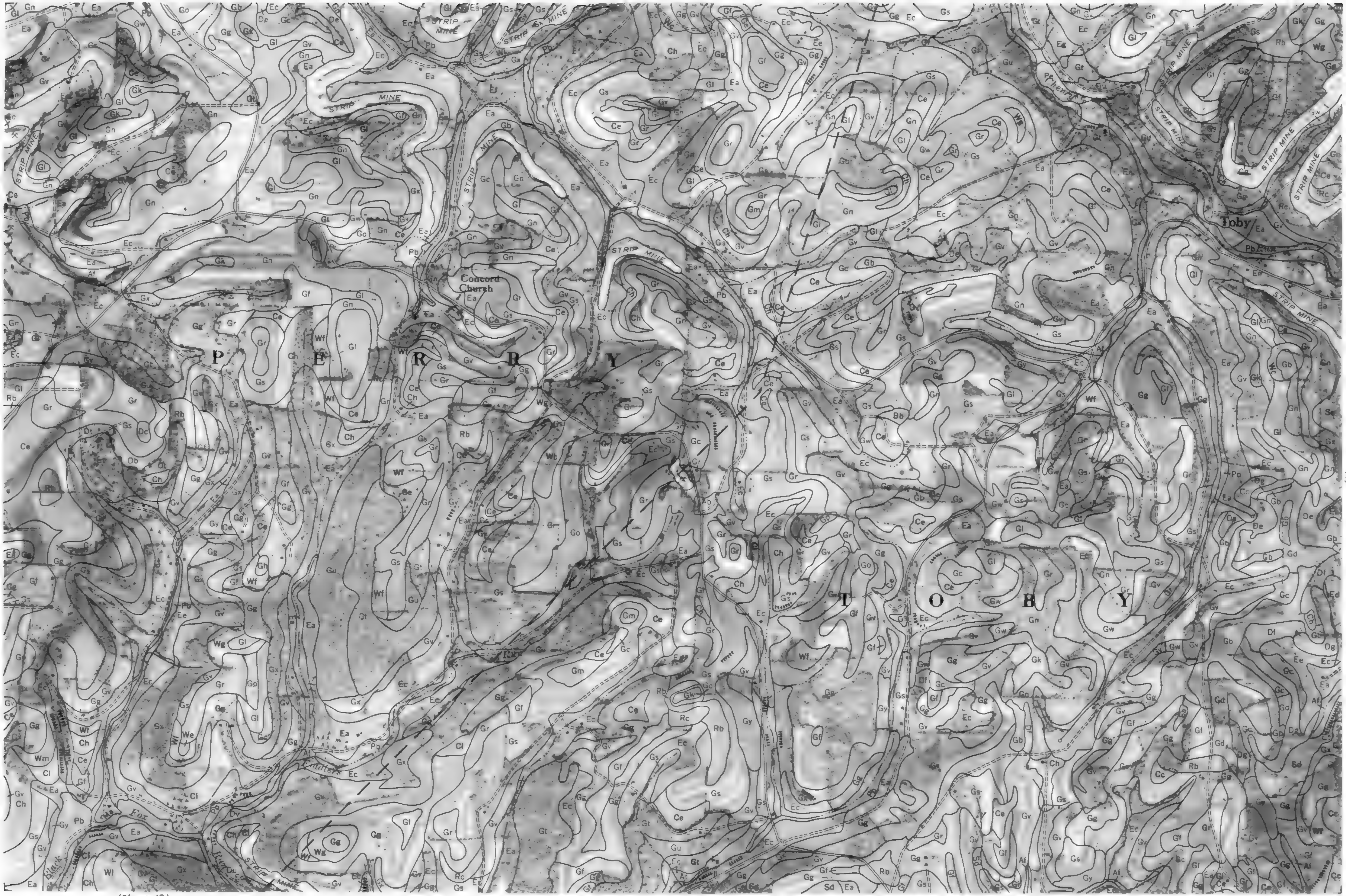
(Inset)

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

(Sheet 32)



(Sheet 43)

Scale 1:20000

0 ½ 1 Mile

0 5000 Feet

(Sheet 38)

(Sheet 40)

(Sheet 44)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

CLARION COUNTY, PENNSYLVANIA

(Sheet 34)

N

M O N R O E

P O R T E R

Piolett

STRIP MINE

STRIP MINE

STRIP MINE

Creek

Creek

Creek

Creek

Creek

Creek

(Sheet 39)

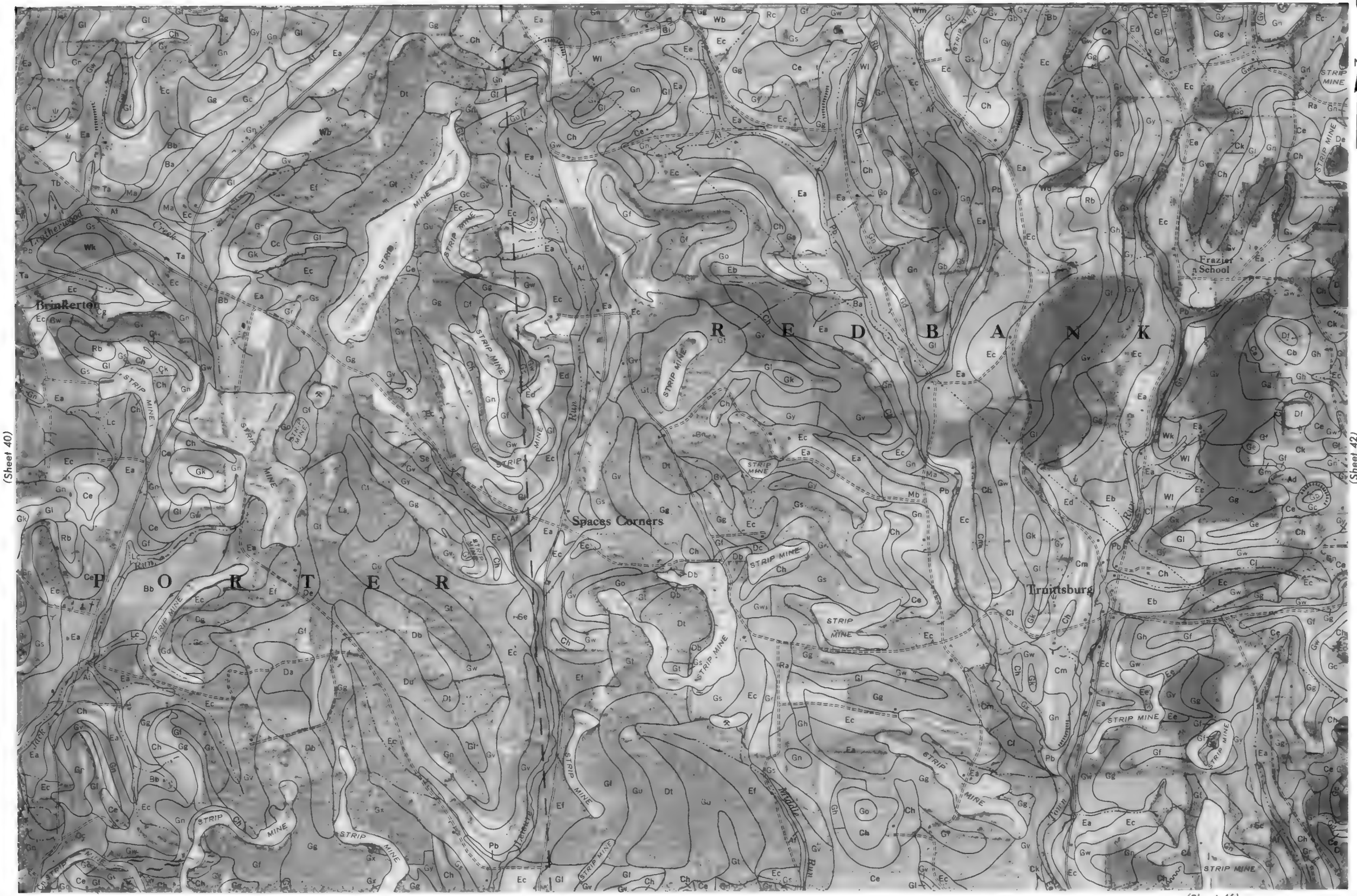
(Sheet 41)

(Sheet 45)

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet



(Sheet 40)

(Sheet 42)

(Sheet 46)

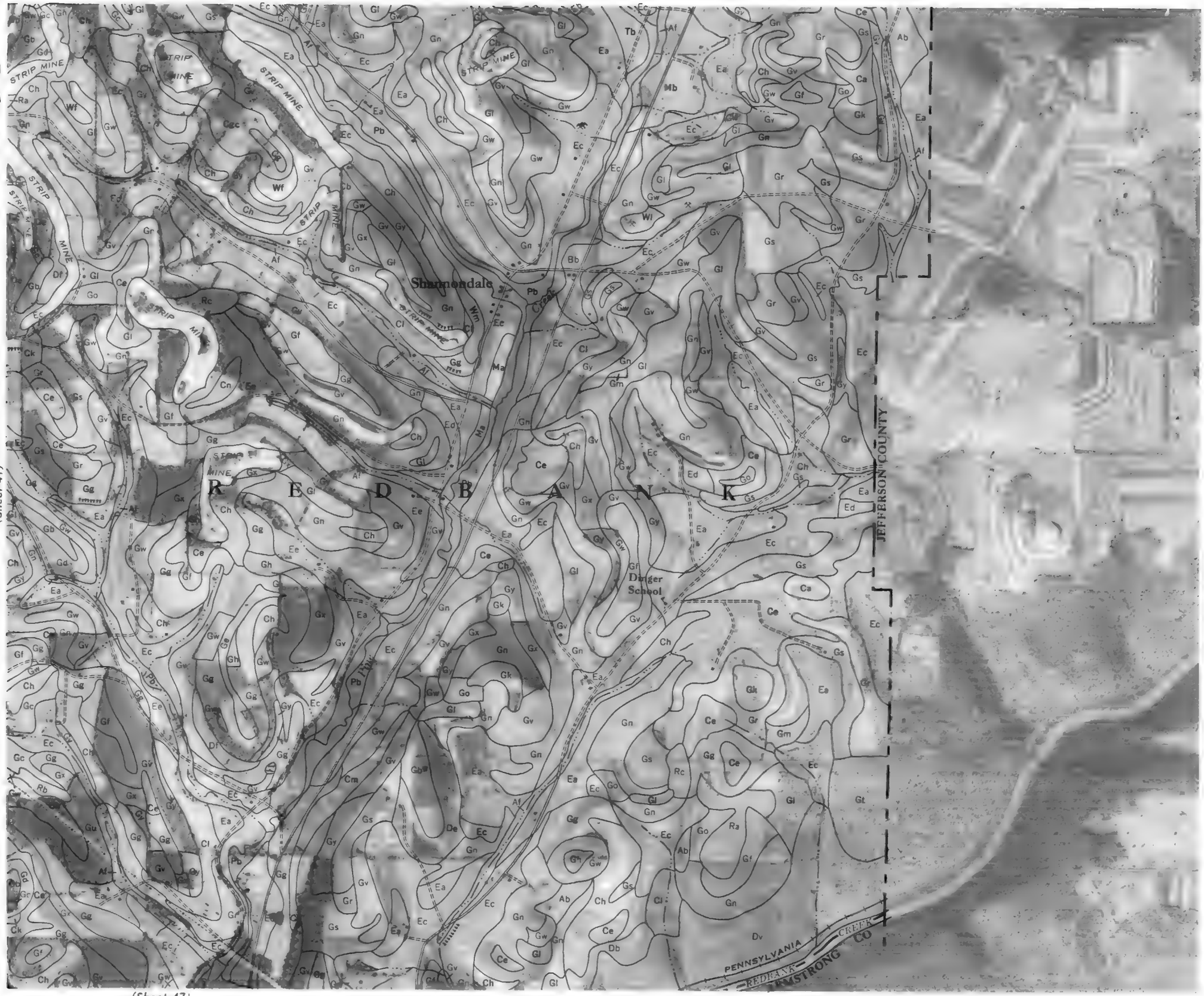
0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

(Sheet 36)

N



(Sheet 41)

(Sheet 47)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

(Sheet 38)

(Inset Sheet 37)

P E R R Y

T O B Y

M A D I S O N

N

Upper Hillville

Kissingers Mill

Sandy Hollow

Sarah Furnace

Catfish

ARMSTRONG COUNTY

ARMSTRONG COUNTY

ALLEGHENY RIVER

PENNSYLVANIA

Catfish Run

STRIP MINE

STRIP MINE

(Sheet 44)

(Sheet 48)

0 ½ 1 Mile

Scale 1:20 000

0 5000 Feet

(Sheet 39)

N

T O B Y

Rimersburg

Maple Grove

M A D I S O N

Diamond

New Athens

Wildcat

East Fork

Chestnut Ridge

STRIP MINE

KEYSTONE MINE

PENNSYLVANIA

(Sheet 43)

(Sheet 45)

(Sheet 49)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet

(Sheet 40)

(Sheet 44)

(Sheet 46)

(Sheet 50)

N

Rockville

Squirrel Hill

Leatherwood

Smithland

Leatherwood Station

PORTER

Chestnut Ridge

Fiddlers Run

Rattlesnake Run

Leatherwood Creek

Redbank Creek

STRIP MINE

PENNSYLVANIA

ARMSTRONG COUNTY

0 1/2 1 Mile

Scale 1:20000

0 5000 Feet

(46)

(Sheet 41)

N

P O R T E R

R E D B A N K

Cottage Hill

New Bethlehem

Fairmount City

Oak Ridge

Hawthorn

REDBANK CREEK

ARMSTRONG COUNTY

PENNSYLVANIA

STRIP MINE

Middle Run

Leisure Run

(Sheet 45)

(Sheet 47)

(Inset Sheet 50)

0 ½ 1 Mile

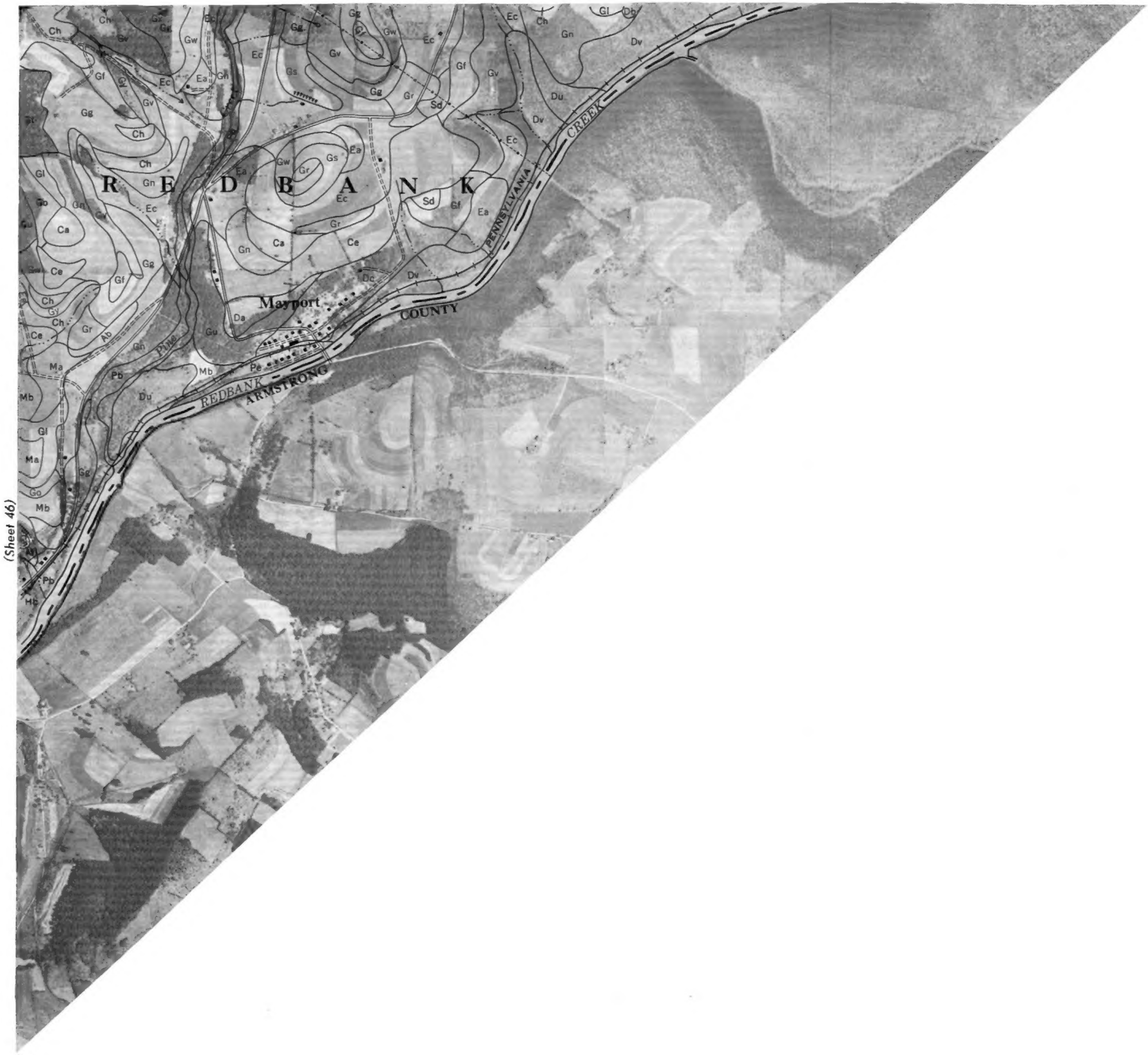
Scale 1:20000

0 5000 Feet

(Sheet 42)

(47)

N



(Sheet 46)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

(Sheet 43)

N

ARMSTRONG COUNTY
PENNSYLVANIA

M A D I S O N

East Brady

B R A D Y

Phillipston

Redbank

ARMSTRONG COUNTY

PENNSYLVANIA
RIVER

REDBANK CREEK

ALLEGHENY

(Sheet 49)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

(Sheet 48)

(Sheet 50)

0 ½ 1 Mile Scale 1:20000 0 5000 Feet

(Sheet 45)

(Inset)

N

PORTER

STRIP MINE

Saint Charles

PENNSYLVANIA

ARMSTRONG COUNTY

REDBANK CREEK

Leatherwood

Climax

(Sheet 49)

(Sheet 46)

New Bethlehem

(Sheet 50)

0 ½ 1 Mile

Scale 1:20000

0 5000 Feet